

2000
B-33
E-17

QUEENSLAND

BUREAU OF SUGAR EXPERIMENT STATIONS

DIVISION OF ENTOMOLOGY
BULLETIN No. 3.

Notes on Insects
Damaging Sugar-Cane in Queensland

BY

EDMUND JARVIS,
Entomologist.

1916.

BRISBANE :

By Authority: Anthony James Cumming, Government Printer.

QUEENSLAND

BUREAU OF SUGAR EXPERIMENT STATIONS

DIVISION OF ENTOMOLOGY
BULLETIN No. 3.

Notes on Insects
Damaging Sugar-Cane in Queensland

BY

EDMUND JARVIS,
Entomologist.

1916.

BRISBANE :

By Authority: Anthony James Cumming, Government Printer.

Bureau of Sugar Experiment Stations,

Brisbane, 31st March, 1916.

The Under Secretary, Department of Agriculture and Stock, Brisbane.

SIR,—I have the honour to submit for publication, as Bulletin No. 3 of the Division of Entomology of the Bureau of Sugar Experiment Stations, the following notes on “Insects damaging Sugar Cane in Queensland,” by Mr. Edmund Jarvis.

I have, &c.,

HARRY T. EASTERBY, General Superintendent.

Notes on Insects Damaging Sugar-Cane in Queensland



By EDMUND JARVIS, Entomologist

INTRODUCTION.

DURING the course of recent experimentation relative to the control of "white grubs" in our Northern canefields opportunities were afforded for studying the economy of common insect pests of this important plant, some of which, although fortunately less harmful than certain species of root-eating Scarabaeidae, are nevertheless decidedly injurious to sugar-cane, and have not hitherto been figured or described. This research work was conducted under the direction of the Bureau of Sugar Experiment Stations, at Gordonvale Experimental Laboratory, situated in the Cairns district—a sub-tropical portion of the State favoured with an annual average rainfall exceeding 92 inches, while the yearly minimum and maximum temperatures range respectively from 68.4 to 83.7 degrees Fahr. The land around Gordonvale is for the most part of volcanic origin, formed of friable soils varying in colour from light-red to chocolate, the latter class being as a rule deep and exceedingly fertile; but includes also extensive alluvial deposits composed of rich sandy or clay-loams eminently suitable for the cultivation of sugar-cane.

The surrounding country, which is uniformly flat and almost encircled by mountain ranges, supports a somewhat stunted vegetation consisting principally of eucalypts and acacias, with an undergrowth of coarse grasses interspersed with various low-growing herbaceous plants.

The following notes must be considered simply as a brief record of field and other observations, made during a period of about twelve months, and confined almost exclusively to a very limited area within two miles radius of Gordonvale.

Messrs. Girault and Dodd have recently published details of preliminary work regarding the metamorphosis of several injurious cockchafers (Qld. Bureau Sugar Expt. Stns., Div. Ent., Bull. No. 2, 1915), so that in dealing with this section of cane pests (Section E in the present bulletin) I have avoided a recapitulation of facts already known, and merely recorded personal observations on the control, parasitism, and general appearance of adults of our more important root-eating cane beetles, referring the reader to Bull. No. 2 of this Bureau for data respecting the life-cycle of *Lepidiota albohirta* and other allied forms.

Similarly, when alluding to such well known pests as the " Beetle Borer " (*Rhabdocnemis obscurus*), and " Army Worm " (*Cirphis unipuncta*), specific characters, etc., are omitted, as the student may, if inclined, consult a mass of existing literature dealing comprehensively with the subject.

Descriptions of general colouration indicate the appearance of larval, pupal, or adult forms when viewed with the naked eye, and are purposely worded in simple language with a view to enabling cane-growers to recognise specimens.

A small glossary comprising the few technical terms made use of will be found on page 43, and should prove very helpful.

Details respecting puncturation, sculpture, scales, and the anatomy of insects were for the most part observed with an ordinary pocket lens of moderate power.

I have not attempted a general treatment of the question of repressive methods, feeling that the scope of this handbook precludes extended discussion of so important a subject, and believing that it would be wiser to postpone the publication of fullest information on this heading until such times as it may become advisable to issue leaflets or pamphlets dealing with individual species.

All localities of infestation, unless otherwise specified, to be taken as meaning Gordonvale.

Original illustrations are by the author; photos by the Qld. Dept. of Agriculture.

My thanks are due to Dr. A. J. Turner, Brisbane; Mr. A. M. Lea, South Australia; Mr. W. J. Rainbow, F.L.S., and Mr. W. W. Froggatt, F.L.S., New South Wales; and Mr. G. Lyell, of Gisborne, Victoria, for the identification of several doubtful species.

In view of the fact that our insect pests of sugar-cane include representatives of several natural orders, and consequently differ greatly in habits, I have thought it best to arrange them under the following five headings, one of which (Section E) has for convenience been further subdivided into two classes.

Section A—Insects boring Cane-stalk and Mid-rib of Leaf.

Section B—Insects eating " Sets " and Stalk below ground.

Section C—Insects attacking the Foliage.

Section D—Sap-sucking Insects.

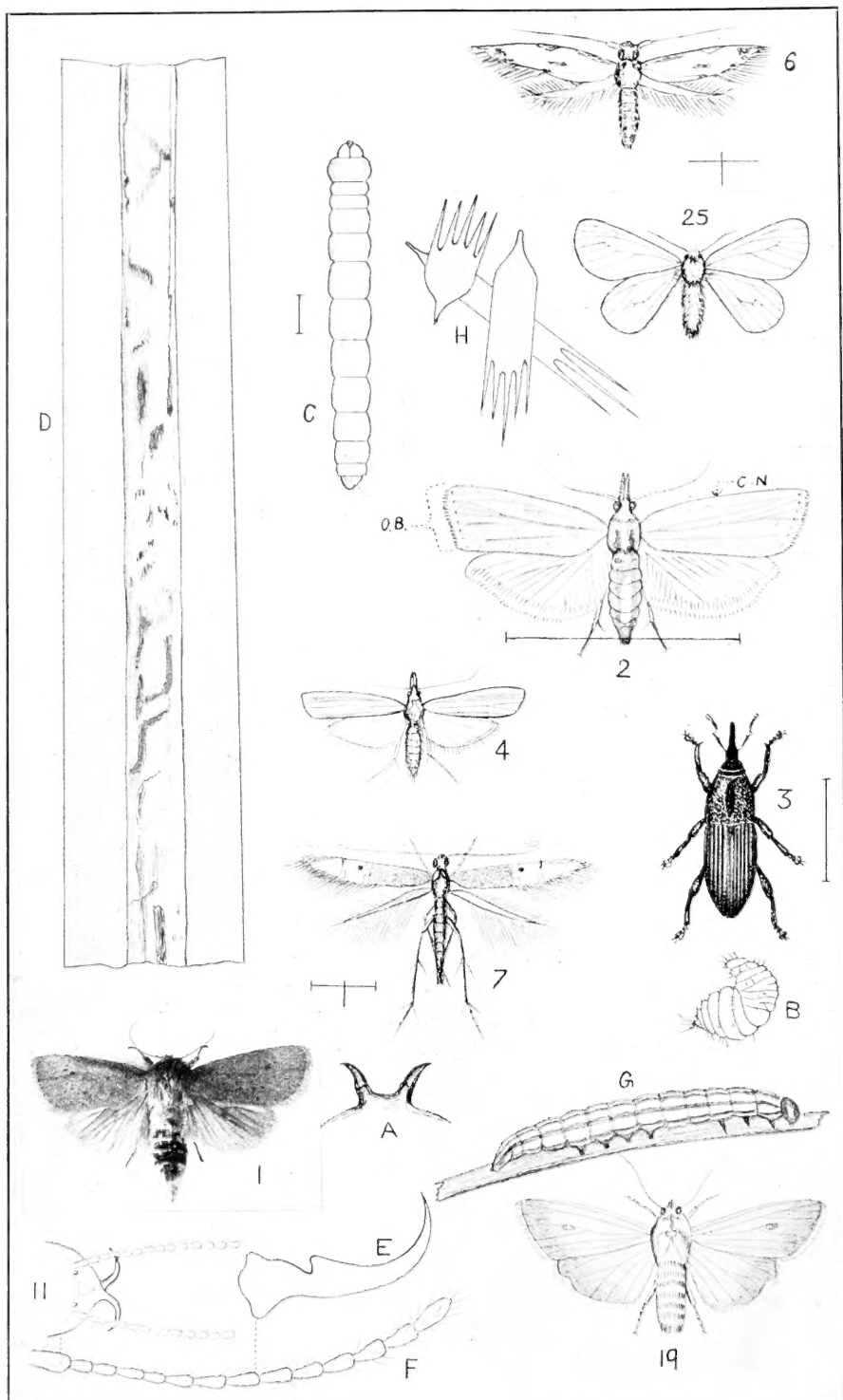
Section E—Insects devouring the Roots.

Class I.—Notably Injurious species.

Class II.—Slightly Injurious species.

PLATE I.

- Fig. 1—*Phragmatiphila truncata*, Walk. "Noctuid Moth Borer" (natural size).
A.—Horns on tail-end of pupa of same (magnified ; Q. Dep. Agric.).
- Fig. 2—*Diatraea saccharalis*, Fabr. "Moth Stalk-Borer" (enlarged ; after Howard, U.S. Dep. Agric.)
- Fig. 3—*Rhabdocnemis obscurus*, Boisd. "Beetle Borer" (enlarged).
B.—Grub of same (natural size ; after Terry).
- Fig. 4—*Polyocha* sp. "Moth Shoot-Borer" (natural size ; original).
- Fig. 6—*Loxostoma* sp. ? "Bud Moth" (magnified 4 times ; original). (See also Plate II).
- Fig. 7—*Cosmopteryx* sp. "Leaf-Rib Borer" (magnified 5 times).
C.—Larva of same (highly magnified).
D.—Nature of injury to mid-rib of cane leaf (all original).
- Fig. 11—"White Ant" (*Termes meridionalis*, Frogg). Antennae and part of head of soldier ant (enlarged).
E.—Mandible of same (highly magnified).
F.—Antenna of same (highly magnified ; all original)
- Fig. 19—*Cirphis unipuncta*, Haw. "Army Worm" (natural size).
G.—Caterpillar or cutworm of same (natural size ; after Wills).
- Fig. 25—*Euproctis holoxutha*, Turner. "Brown-tail Moth" (natural size).
H.—Wing scales of same (highly magnified ; original).



E. Jarvis, Del. Q. Dep. Ag. Photos.

PLATE I.

Insects attacking Stalk, Foliage, and "Sets" of Sugar Cane.

Section A.—Insects boring Cane-stalk and Mid-rib of Leaf.

- (1) "Noctuid Moth-Borer." (*Phragmatiphila truncata*, Walk.)
- (2) "Moth Stalk-Borer." (*Diatraea saccharalis*, Fabr.).
- (3) "Beetle Borer." (*Rhabdocnemis obscurus*, Boisd.).
- (4) "Moth Shoot-Borer." (*Polyocha* sp.).
- (5) "Bud Moth," No. 1. (*Opogona glycyphaga*, Meyr.).
- (6) "Bud Moth," No. 2. (*Loxostoma* ? sp.).
- (7) "Leaf-Rib Borer." (*Cosmopteryx* sp.).

(1) **PHRAGMATIPHILA TRUNCATA**, Walk. (Family NOCTUIDAE).

Synonymy—*Nonagria exitiosa*, Oliff.: *Leucania leonina*, Walk.

Plate I., Fig. 1, p. 6.

This species has long been familiar to entomologists under the name of *Nonagria exitiosa*, and as far back as 1891 was recorded as a serious cane pest in New South Wales. It has been taken also in South Australia and Tasmania, and in our own State occurred injuriously in the Mulgrave district in 1907, and later (1909) at Bundaberg, but up to the present has not, I understand, occasioned serious damage in Northern Queensland.

In the course of investigation at Pyramid it was noticed that larvae of this insect generally gnaw one or more holes about a sixteenth of an inch in diameter through the sides of affected shoots, usually close to the ground, but sometimes just above it. Happily for the grower, these tiny holes—which apparently act as safety valves for the escape of carbonic acid gas, and admittance of fresh air to the interior—afford a ready means of ingress to parasitic and predaceous foes, which doubtless destroy large numbers of the caterpillars. The notorious ant *Pheidole megacephala* is not slow to take advantage of so ready a means of invading the tunnels, and I am of opinion that in the event of its thorough establishment on a plantation might prove an important controlling factor in this connection. Its presence, however, is undesirable in cane-fields infested by the "beetle borer" *Rhabdocnemis obscurus*, as this ant is known to seriously check the increase of certain dipterous parasites that help to control the ravages of weevil borers.

Two kinds of hymenopterous insects have been previously recorded as parasitic on *P. truncata* in New South Wales.

One of these, *Apanteles nonagriæ*, is credited with destroying about fifty per cent. of the caterpillars, while the other hymenopteron, *Euplectus howardi*, attacks the pupa, effectually preventing the emergence of myriads of moths that would otherwise cause immense damage. Probably these, and other valuable parasites, occur also in Queensland. Larvae collected at Pyramid yielded specimens of a large tachinid fly, not yet identified.

This pest was observed by the writer during October, 1914, damaging ratoon and plant cane by tunnelling and killing the young suckers. Upon cutting open an affected shoot the centre was seen to be hollow, often down to the roots, and more or less choked with excreta; or else partly transformed into a brown evil-smelling mass of decomposing fibres.

In September, when growth is just commencing, a single caterpillar is able to kill many shoots; in some cases stools had lost over a dozen; this, however, was doubtless due to the presence of more than one borer. Injurious symptoms are very conspicuous in the field, as the central leaves of affected plants, being at once killed, turn brown in a few days.

Description of Larva.

General colour light-purplish, blotched indistinctly with dull white. Head bright to very dark red. Prothoracic collar light-yellow. Dorsal surface of 2nd and 3rd thoracic segments deeply wrinkled. Abdominal segments 1 to 8, with four black dots on dorsal area, each encircled by a whitish ring, the anterior pair closer together than the others, except on 8th segment, on which they are wider apart than the posterior pair; 9th segment with a row of six large smoky blotches close to posterior margin. Anal segment light-yellow, shining, with 8 dull yellow hairs arranged in two transverse rows, each hair being encircled by a tiny black ring. Spiracles surrounded by four very irregular unequal sized smoky blotches larger on 8th abdominal segment. All dots and blotches mark the site of a single short brown hair. Ventral surface dirty white, prolegs and sides of claspers yellow. Length, 25 mm. to 38 mm. (1 to 1½ inches). The larva when disturbed invariably seeks the bottom of its tunnel, making no attempt to vacate it unless the shoot be sectioned lengthwise, when it drops hastily to the ground and remains motionless. When fully grown it pupates either in the centre of injured suckers amongst moist excreta, or outside close to the ground against the bases of dead canes, or under withered leaf-sheaths and débris previously webbed together to afford temporary protection.

Description of Pupa.

Reddish-yellow, darker on head, back, and anterior edges of segments. Head-end abruptly rounded bluntly. Extremity of anal segment very dark red, flattened, with two short curved hooks turned up at an angle towards dorsal surface (*see* Plate I., Fig. A), and near them a short longitudinal groove on ventral area. Abdominal segments punctured near anterior margins, particularly on their dorsal surfaces. Length, 19 mm. The pupal stage of first brood in November occupies twelve days under an average shade temperature of 77 deg. F.

Description of Moth.

Fore-wings light yellowish silvery-brown, with a row of minute black dots on edge of outer border, an oblique irregular row near centre of wings, and a few dots on basal area. Hind-wings paler and without spots. Antennæ setaceous in female and with two rows of pectinations in male. Wing expanse variable, averaging $1\frac{1}{2}$ inches. The eggs of the first Spring brood are laid towards the end of July.

(2) **DIATRAEA SACCHARALIS**, Fabr. (Family CRAMBIDAE).

Plate I., Fig. 2, p. 6.

Like the preceding insect this notorious moth appears to be under effective natural control in Queensland and cannot be classed as a serious pest.

I have not yet had an opportunity of studying its life-history or economy. It will be of interest to mention, however, with reference to control measures, that experiments conducted in Texas, U.S.A., during 1914, showed that the average infestation of fields in which trash had been buried was 30.6 per cent., as against 76 per cent. in burned fields, the lower percentage being due to the destruction of egg parasites on the foliage and in the egg masses of borers attached to the leaves.

The small proportion of borers left in cane tops and stubble after harvesting reappear the following season, and on plantations where trash is buried, or better still raked to the headlands, are met by their parasites, which are thus able to render great assistance by promptly destroying the eggs of the first brood of moths.

(3) **RHABDOCNEMIS OBSCURUS**, Boisd. (Family CURCULIONIDAE).

Plate I., Fig. 3, p. 6.

This formidable insect has apparently become firmly established in the Johnstone River district, where it not only exercises an appreciable influence on the quality and weight of crops but is said to annually destroy thousands of tons of cane. It was troublesome locally at Mackay and Mossman during 1909-11, and in June of the following year (1912) occurred in various localities at Innisfail, attacking Badila cane and occasioning serious losses.

The Queensland Government Entomologist, Mr. Tryon, whilst in New Guinea discovered a tachinid parasite of this pest which subsequently received the name of *Ceromasia sphcnophori*, Vil., and in 1911 was introduced into Fiji, where it quickly spread and is now reported to be successfully combating the beetle-borer. Larvæ of this useful fly were later (1914) brought to North Queensland by the Colonial Sugar Refining Company, and the imagines bred from same liberated among infested cane on the Johnstone River. Control measures practised by

growers in the above district consist in the use of well-known baits composed of short pieces of split cane which are laid on headlands. They have also found it a good plan to clean up all cane sticks lying on the ground, broken tops, &c., these having been noticed to be more badly infested than undamaged cane. Mr. R. Davis, of Daraji, has observed that this beetle works in the centre as well as borders of a field and apparently prefers variety Badila to any other.

(4) **POLYOCHA**, sp. (Family PYRALIDAE).

Plate I., Fig. 4, p. 6.

This interesting moth-borer, which has not previously been recorded as a cane pest in Queensland, was found by the writer damaging young ratoon shoots at Pyramid during November, the injury occasionally being identical in character with that caused by the well known "Noctuid Moth-Borer" (*Phragmatiphila truncata* (see pages 7-8)).

Although of little economic importance, the species deserves mention in view of its harmful propensities and possible increase in the future. An allied species, *Polyocha saccharella*, Dugl., attacks sugar-cane in India.

Description of Larva.

General colour light bluish-green. Prothoracic-plate black, with anterior margin green. Second thoracic segment with a centro-dorsal smoky-brown blotch adjoining prothoracic-plate and enclosing a central black blotch. Abdominal segments with a dark-brown median line of blotches, and dorsal surface more or less clouded with light pink. Anal segment with a small terminal dark-brown plate, and red extremity. Prolegs green; anal claspers blotched on outer sides with dark brown. Head light yellow; mandibles black. Body tapering towards each end and supporting a few scattered long white hairs. Length, about 11 mm. The larva pupates in its tunnel in the centre of the shoot; a specimen at the Laboratory assumed the pupal stage on 22nd November, the imago emerging on 12th December, after an interval of twenty days.

Description of Pupa.

Yellowish-brown, darker on head-end. Abdominal segments coarsely punctate, except on hind margins—viz., about one-third width of segment—which are smooth, and brown instead of cream-coloured. Extremity of anal segment blunt and rounded, but without hooks or spines. Length, 15 mm. Greatest width, 3.50 mm.

Colouration of Moth.

Fore-wings shaded with pinkish-gray; the nervures, costal border, and areas between lower radial nervure and inner margin of wing

creamy-white. Outer margin edged with three rows of flesh-coloured spatulate scales. Hind-wings pale silvery-yellow suffused with gray on apical area and extreme edge of outer margin. Head, thorax, and palpi pinkish-white, the last mentioned porrected and snout-like. Abdomen dark-gray, barred transversely with narrow silver bands; anal segment tufted with yellow scales. Centre and distal end of hind tibiae armed with two spurs of unequal length; intermediate tibiae with two distal spurs. Wing expanse, 31 mm. (about $1\frac{1}{4}$ inches). Length of body, 15 mm.

(5) **OPOGONA GLYCYPHAGA**, Meyr. (Family TINEIDAE).

Plate II., Fig. 5. J-N., p. 13.

Although of little economic importance, this insect occasionally proves injurious to seed cane, the caterpillars sometimes destroying as much as 80 per cent. of eyes in soft varieties like "Clark's Seedling" (H.Q. 426).

In addition to direct injuries of this nature, they feed on the leaf-sheath, gnaw the surface of the rind close to buds, and frequently bore into cane stalks, thus producing various wounds that court invasion from fungus diseases.

Owing to secluded habits and the insignificant size of both larva and adult, a moderate infestation may easily remain unnoticed in the field, especially when affecting varieties of hard cane. "Badila" is freely attacked at Gordonvale, but injuries appear to be confined principally to the epidermis of the rind in the immediate vicinity of nodes, and to softer basal portions of the leaf-sheath and arrow. The succulent leaf-stalks of the banana and fruit of the granadilla are also tunnelled by larvæ of this pest.

Appearance of Larva.

Body translucent; general colour pinkish-yellow. Head dark reddish-brown with several rather long yellow hairs. Prothoracic segment smooth and shining, pale-yellow, shading to brown on posterior half, which constitutes a collar extending nearly to spiracles, and with a darker brown plate on each side on spiracular area forming a continuation of the dorsal collar but separated from it. Meso- and metathoracic segments each with 10 large yellowish-brown blotches of unequal size above spiracles, and a narrow transverse blotch between spiracles and legs. Abdominal segments with four small dark spots arranged in subdorsal lines extending the length of body, and four spots on each side grouped around spiracles. Ventral area of first, second, and last three abdominal segments with a transverse row of about eight smaller spots. Blotches on thoracic segments bear two yellow hairs, and abdominal spots a single hair. Anal segment terminated by a light

PLATE II.

Fig. 5—*Opogona glycyphaga*, Meyr. “Bud Moth” (magnified 5 times; Q. Dep. Ag.).

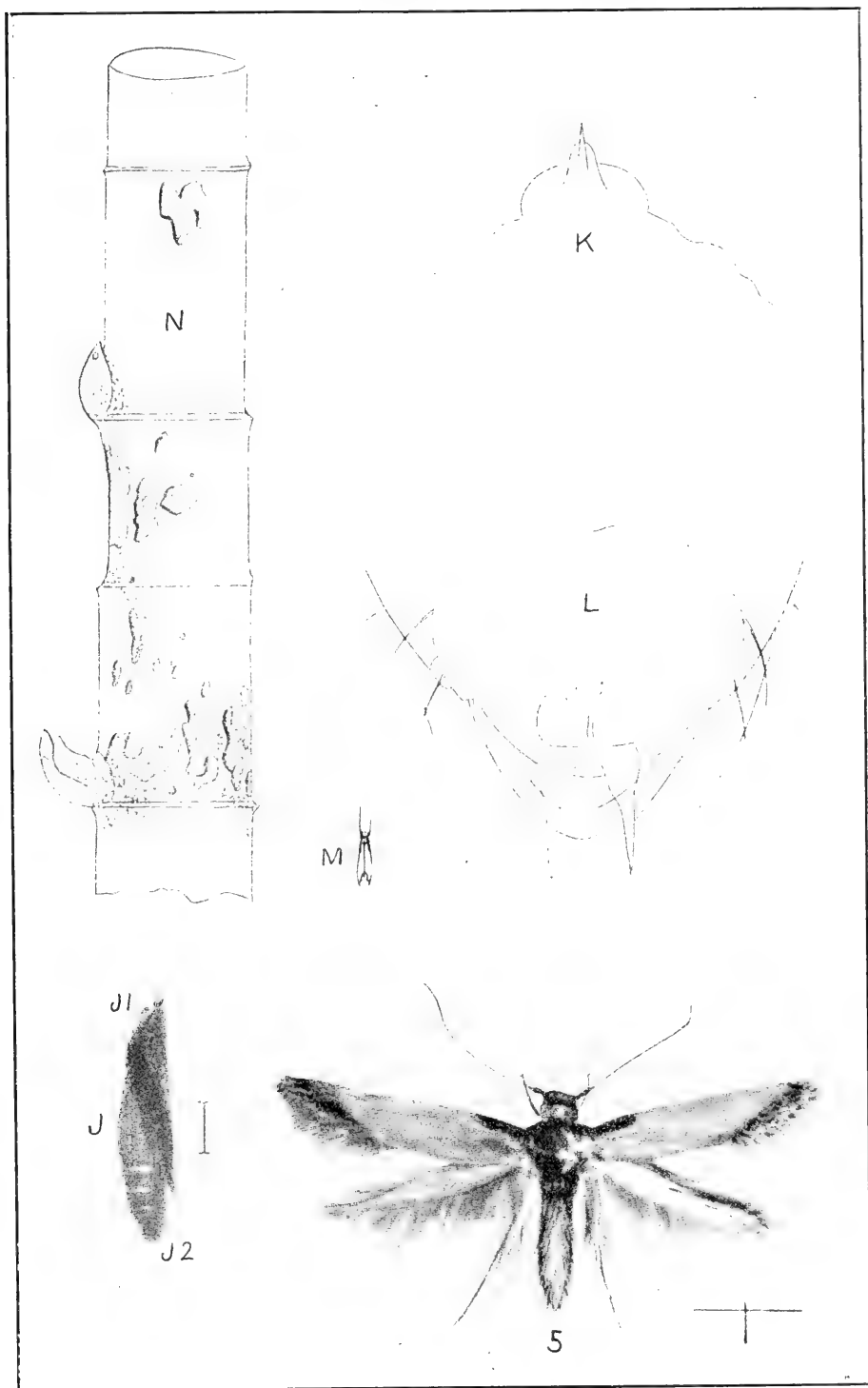
J.—Pupa of same (magnified 5 times; Q. Dep. Ag.).

K.—Ventral surface of head of pupa at J 1 (magnified; original).

L.—Extremity of anal segment of pupa at J 2; as seen when pupa lies on its back with end of abdomen turned up (highly enlarged; original).

M.—“Bud Moth” in resting position (natural size).

N.—Diagrammatic sketch of damaged cane stalk (original).



E. Jarvis, Del. Q. Dep. Ag. Photos.

PLATE II.

Sugar Cane Bud-Moth; destroying Eyes and damaging Stalk.

brownish-yellow semi-circular patch bearing eight long yellow hairs. Length of body, 16 mm. (about $\frac{5}{8}$ of an inch). The caterpillars are usually more or less in evidence during stripping or loading operations, being forced at such times to explore the surface of defoliated canes in search of congenial hiding-places.

Description of Pupa.

Light yellow suffused with reddish on dorsal surface. Abdominal segments each with a transverse ridge near anterior margin, surmounted by dark-brown spines. Ventral surface light yellow except on head-end and anal segment, which are clouded with reddish, darkening towards extremities. Legs and antennæ distinctly outlined in light-red, the latter meeting centrally on fifth and sixth segments and projecting slightly beyond wings. Top of head prolonged into a somewhat conical cap terminating ventrally in a short sharp spine. (Plate II., Fig. K.) Eyes black. Anal segment provided with two short dark-red curved spines situated dorsally and directly upwards. (Plate II., Fig. L.)

Pupation takes place under a silken covering spun by the larva and completely hidden under pellets of its excreta ingeniously fastened to the outside. It is usually concealed between the leaf-sheath and cane-stalk and attached near the base of the former or more rarely to rind close to a node.

The moth before emerging works the pupa partly out of its cocoon-like covering, leaving half of the broken pupal shell protruding from one end.

Colouration of Moth.

Female:—Fore-wings ochreous-yellow, with an elongate purple blotch at base of costa and a large blotch of same colour on apical margin. Hind-wings pale-yellow speckled with gray; fringes light shining yellow. First few joints of antennæ, upper surface of prothorax, and top of head thickly clothed with purple scales, which viewed with an ordinary pocket lens are seen to flash with metallic crimson tints. A sort of comb-like ruff of these beautiful scales occurs in front of the head, and they are scattered also over a portion of the blotches on fore-wings. Abdomen golden shaded with iridescent light green. Hind femora densely covered with long golden hairs. Wing expanse, 16 mm.; length of body, 6.40 mm. (about $\frac{1}{4}$ of an inch).

The moth rests by day in a conspicuous position on leaves of sugar-cane, etc., with its wings enfolding the body, and antennæ laid flat on the surface, projecting straight in front of its head in parallel lines that appear to emerge from the sides of the thorax, this deception being due to a curious disposition of the large, movable, first antennal joint, which

is scape-like and directed obliquely to each side of the head. (Plate II., Fig. M.) A fuller account of this cane pest, including notes on its control, are given in a paper by the writer entitled "The Sugar-Cane Bud-Moth" (*Queensland Agricultural Journal*, vol. 3, p. 72, 1915). A chalcid parasite, *Stomatoceras gracilicorpus*, Girault, has been bred by us from pupæ of this moth.

(6) **LOXOSTOMA**, ? sp. (Family TINEIDAE).

Plate I., Fig. 6, p. 6.

Closely resembles the foregoing in general habits and economy, but is a smaller and seemingly less plentiful species.

Colouration of Moth.

Fore-wings light-yellow with three brown blotches on costa, edged with golden scales, the blotch at basal portion of wing being about twice the length of the others; a short bar consisting of golden scales is placed lengthwise in centre of wing, and the fringed portion of hind margin blotched irregularly with golden and dark-brown scales. Hind-wings and all fringes silvery brown. Antennæ light yellow, basal joint swollen and brown. Front of head and patagia tufted with large reddish-brown scales. Wing expanse, 9 mm. Length of body, 4 mm.

(7) **COSMOPTERYX**, sp. (Family ELACHISTIDAE).

Plate I., Fig. 7 C-D, p. 6.

This insect occurs more or less freely in canefields but fortunately rarely attacks very young foliage.

The larvæ bore the mid-rib, occasioning internal injuries, which soon become conspicuous owing to the damaged tissue turning red and revealing the presence of extensive tunnelling (*see* Plate I., Fig. D). Injuries are confined chiefly to the basal portions of older leaves but may extend the whole length of the mid-rib, and exceptionally cause premature withering of the leaf-blade.

Description of Larva.

Dull white, deeply segmented, and with a few scattered short white hairs. First thoracic segment wider than the others. Head large, eyes light yellow, mandibles brown. Length, 6 mm. (*see* Plate I., Fig. C).

Colouration of Moth.

The perfect insect is beautifully adorned with the broad golden fascia and metallic blotches so characteristic of this interesting genus, and with the help of a pocket lens is easily identifiable from the following description:—Thorax and basal half of fore-wings gray, striped longitudinally with silver. Dorsal surface of head smooth and white. Fore-wings just beyond middle crossed by a broad transverse golden-

yellow band margined with blotches of metallic silver, the hindermost margin being marked with two blotches, one of which is contiguous to a very conspicuous black spot near costa; fringes light-gray, nearly twice as long as greatest width of wing. Hind-wings gray, very narrow, basal fringe more than half the length of wings. Antennæ about length of body, grayish-brown, with extremity and a ring near same white. Eyes brick-red. Dorsal surface of abdomen brownish; sides and venter silvery. Wing expanse, 8.50 mm. Length of body, 3.40 mm. Artificial light attracts this moth.

A related species, *Cosmopteryx pallifasciella*, Snell, affects sugar-cane in Java.

Section B.—Insects eating “Sets” and Stalk below ground.

- (8) “Black Gauger” (*Heteronychus* sp.).
- (9) “Set Eater” (*Pentodon australis*, Blackb.).
- (10) “Wire Worm” (*Monocrepidius* sp.).
- (11) “White Ant” (*Termes meridionalis*, Frogg.)

(8) **HETERONYCHUS**, sp. (Family SCARABAEIDAE).

This dynastid beetle was brought under the notice of the Government Entomologist in 1909 as occasioning damage in the Proserpine district. Mr. Tryon, in his Annual Report, 1909-10, briefly notes its occurrence as follows:—“Injuring the sugar-cane ‘sets’ by gnawing into them, and also damaging the young shoots by similarly injuring the portion of the stem below the soil.” The habits of this pest closely resemble those of *Isodon puncticollis*, a familiar Queensland beetle (Plate IV., Fig. 52) known commonly as the “Stem Gauger,” which, in addition to eating sugar-cane roots, attacks tubers of potatoes and stems of tomato plants, gnawing irregular unsightly holes in the former or damaging and sometimes killing the latter.

(9) **PENTODON AUSTRALIS**, Blackb. (Sub-family DYNASTIDES).

Plate III., Fig. 9, p. 20.

One occasionally sees numerous specimens of this common scarabaeid beetle settled on the ground under electric arc-lights at night in the Brisbane Botanic Gardens.

It has been found eating sugar-cane “sets,” and, although of little or no economic interest at present, is worth watching. A closely related and notably injurious species, *Pentodon monodon*, gnaws through the stems of maize stalks beneath the ground, and has called for repressive measures in Russia; while *Pentodon punctatus*, occurring in France, eats the main root of the chicory plant.

(10) **MONOCREPIDIUS**, sp. (Family ELATERIDAE).

The so-called "wireworm" of our canefields is the larval stage of an elaterid beetle familiarly known by the name of "Skip Jack," owing to its amusing habit of suddenly jumping into the air with a sharp click when laid on its back on a flat surface. Elateridae are susceptible to the influence of artificial light, frequently flying into houses on warm evenings and crawling on tables, &c. In 1910 this pest inflicted serious damage to young cane recently planted on alluvial flats at Mackay; and in the same year occurred very freely in the Central Isis district, where it was reported to be causing more damage than any other insect.

The following brief extract from a letter received from Mr. H. R. Hart, of Mackay, in September, 1915, will serve to illustrate the nature of injuries due to "wireworm":—"The worm attacks the eyes of the 'sets' immediately after planting, apparently feeding on the soft content of the eye, and then passing on to the next 'set,' continuing sometimes from end to end of the field. I have known several cases where fields of cane have had to be ploughed out and replanted from this cause; and in my own experience I once planted a small field of about 2 acres three times with the same result."

Apparently the ravages of this pest are of very local occurrence.

(11) **TERMES MERIDIONALIS**. Family TERMITIDAE).

Plate I., Fig. 11 E-F., p. 6.

Two species of "White ants" are known to destroy sugar-cane "sets" at Gordonvale, occurring as a rule in new ground planted for the first time, but doing little or no damage to crops growing in soil that has been well worked.

Both species are found plentifully in Northern Queensland, but *T. meridionalis* is the principal offender at Gordonvale. The other termite, *Eutermes fumigatus*, is smaller and of very minor importance.

Section C.—Insects Eating the Foliage.

- (12) "Yellow-winged Locust" (*Locusta danica*, Linn.).
- (13) "Large Mottled Locust" (*Locusta australis*, Brunner).
- (14) "Long-nosed Locust" (*Atractomorpha crenaticeps*, Blanch.).
- (15) "Short-horned Locust" (*Oxya velox*, Fab.).
- (16) "Short-horned Locust" (*Cyrtacanthracis ? proxima*, Walk.).
- (17) "Short-horned Locust" (*Cyrtacanthracis plagiat*a).
- (18) "Short-horned Locust" (*Cyrtacanthracis guttulosa*).
- (19) "Army Worm" (*Cirphis unipuncta*, Haw.).
- (20) "Skipper Butterfly" (*Paruara mathias*, Fab.).
- (21) "Skipper Butterfly" (*Telicota augias-kreffti*, MacL.).
- (22) "Skipper Butterfly" (*Padraona marnas*, Feld.).
- (23) "Grass Worm" (*Chusaris rhodias*, Turner).
- (24) "Web Worm" (*Harmologa miserana*, Walker).
- (25) "Brown-tail Moth" (*Euproctis holoxutha*, Turner).

- (26) " Plant-eating Beetle " (*Rhyparida morosa*, Jac.).
- (27) " Plant-eating Beetle " (*Colasposoma sellatum*, Baly.).
- (28) " Plant-eating Beetle " (*Rhyparida* (var. *hasipennis*, Lea ?).
- (29) " Plant-eating Beetle " (*Rhyparida didyma*, Fab.).
- (30) " Leaf-eating Weevil " (*Stenocorynus aridus*, Pasc.).

(12) **LOCUSTA DANICA**, Linn. (Family ACRIDIIDAE).

This handsome grasshopper enjoys an almost world-wide distribution, occurring plentifully not only throughout Australia, but in many other countries. It is at once recognised owing to a curious sharp clapping sound made at intervals by the adult whilst flying, and by the presence of a large patch of bright yellow, deeply margined with black, on the basal portions of wings. In 1912 it occurred in enormous numbers in Western and Northern Queensland, and was reported as damaging sugar-cane in the Cairns and Innisfail districts by stripping leaves to the mid-rib.

The following egg parasites have been bred from this species in Australia:—(1) *Scelio australis*, Frogg.; (2) *Scelio ovi*, Girault. Froggatt has bred a blow fly (*Sarcophaga aurifrons*, Coq.) from adults of *L. danica* collected in New South Wales. I may mention in this connection that no less than six species of Sarcophagidae are known to parasitise grasshoppers in America. One of these, *S. kellyi*, Aldrich, a recently described viviparous blow fly, has been repeatedly observed in the act of infesting flying grasshoppers by depositing minute larvæ on the underside of their unfolded wings. A specimen of *Locusta danica* obtained by the author at Gordonvale last April was found to be infested with several dipterous larvæ, which crawled from their host after it had been killed with cyanide of potassium, but, unfortunately, were affected by the poison and did not develop into flies.

(13) **LOCUSTA AUSTRALIS**, Brunner. (Family ACRIDIIDAE).

Somewhat resembles *L. danica* in size and structure, and usually frequents open forest country in the coastal districts of both Queensland and New South Wales. It is often met with in canefields.

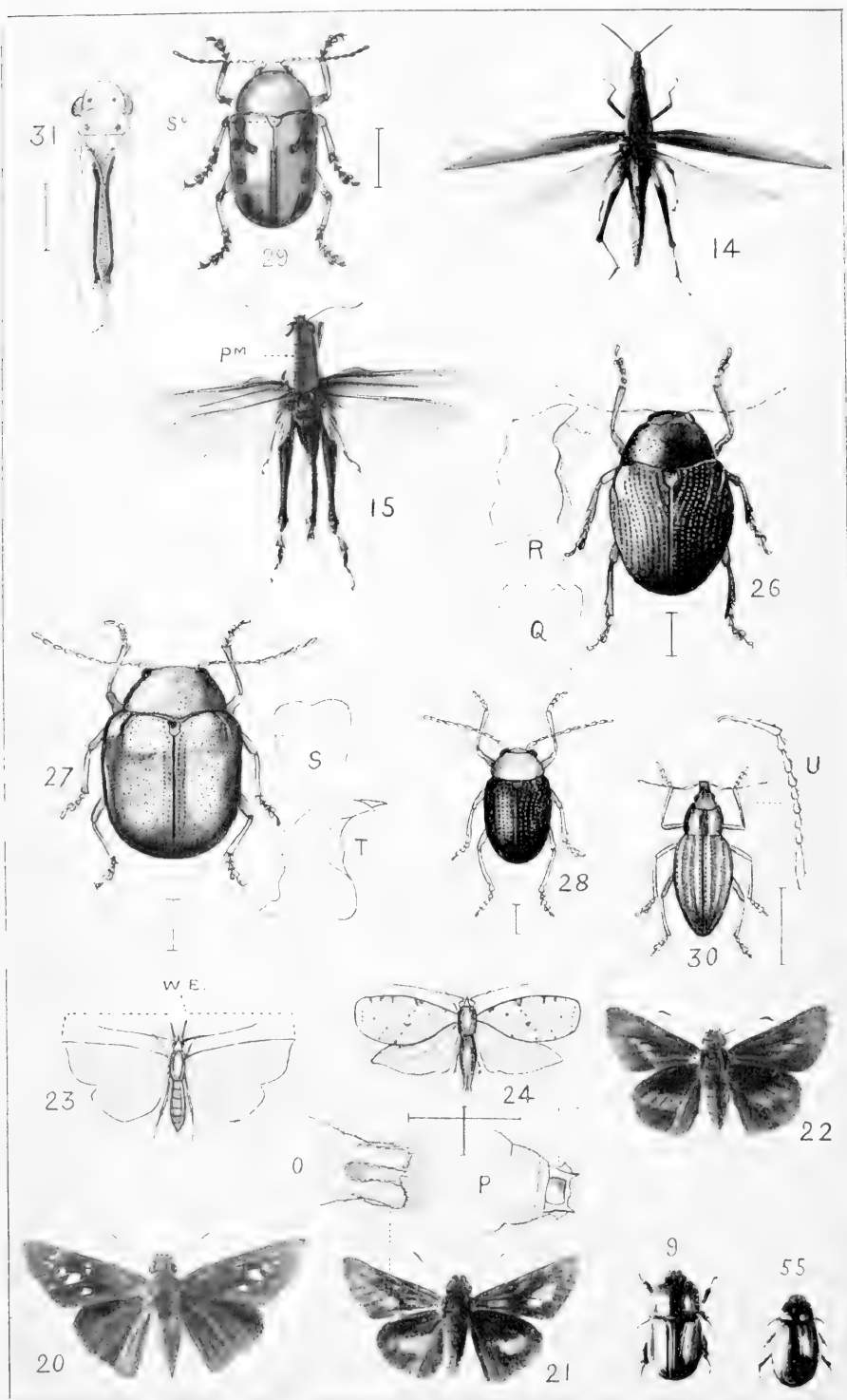
Colouration of Adult.

Wing covers pale brownish-yellow, mottled with six or more oblique brown blotches distinctly separated on apical half and clouded more or less uniformly with the same colour on basal and central areas. Wings clear, main nervures black, neuration between same pale yellow on basal area darkening into brownish towards outer margin. Ends of main nervures at apex of wing and on apical portion of costa shaded with brown. Width across extended tegmina about $3\frac{1}{2}$ inches.

Swarms of these large grasshoppers invaded plantations belonging to the Colonial Sugar Refining Company at Childers in 1904, but were checked by means of screens and pits, and prevented from seriously damaging the young cane.

PLATE III.

- Fig. 9—*Pentodon australis*, Blackb. "Set Eater" (natural size ; Q. Dep. Ag.).
- Fig. 14—*Atractomorpha crenaticeps*, Blanch. "Long-nosed Locust" (natural size ; Q. Dep. Ag.).
- Fig. 15—*Oxya velox*, Fab. "Short-Horn Locust" (natural size ; Q. Dep. Ag.).
- Fig. 20—*Paruara mathias*, Fab. "Skipper Butterfly" (natural size ; Q. Dep. Ag.).
- Fig. 21—*Telicota augias-kreffti*, Mael. "Skipper" Butterfly (natural size ; Q. Dep. Ag.).
o.—Anal segment of pupa of same (magnified ; original).
- Fig. 22—*Padraona marnas*, Feld. "Skipper" Butterfly (natural size ; Q. Dep. Ag.).
r.—Anal segment of pupa of same (magnified ; original).
- Fig. 23—*Chusaris rhodias*, Turner. "Grass Worm" (natural size ; original).
- Fig. 24—*Harmologa miserana*, Walk. "Web Worm" (enlarged ; original).
- Fig. 26—*Rhyparida morosa*, Jac. "Leaf-eating Beetle" (magnified).
q.—Labrum (upper lip) of same (magnified).
r.—Mandible (jaw) (magnified ; all original).
- Fig. 27—*Colosposoma sellatum*, Baly. "Leaf-eating Beetle" (magnified).
s.—Labrum of same (magnified).
t.—Mandible of same (magnified ; all original).
- Fig. 28—*Rhyparida* (var. *hasipennis*, Lea ?) "Leaf-eating Beetle" (enlarged ; original).
- Fig. 29—*Rhyparida didyma*, Fab. "Leaf-eating Beetle" (enlarged ; original).
- Fig. 30—*Stenocorynus aridus*, Pasc. "Leaf-eating Weevil" (magnified).
u.—Antenna of same (highly magnified ; both original).
- Fig. 31—*Tetiqonia parthaon*, n. sp. Kirk. "Leaf Hopper" (magnified ; after Kirkaldy).
- Fig. 55—*Haplonycha* sp. "Cane Beetle" (natural size ; Q. Dep. Ag.).



E. Jarvis, Del. Q. Dep. Ag. Photos.

PLATE III.

Insects Injurious to Foliage, "Sets," and Roots of Cane.

(14) **ATRACTOMORPHA CRENATICEPS**, Blanch. (Family ACRIDIIDAE).

Plate III., Fig. 14, p. 20.

This curious locust differs from the preceding species in general structure, the elongate head being somewhat flattened horizontally and produced into a point. A row of minute pearly bead-like projections forms a longitudinal ridge on sides of head, starting immediately behind eyes and extending along lower edge of pronotum. In both sexes the tegmina (wing-covers) are of a uniform grass-green colour, closely harmonising with that of various cereals, etc., on which the insect subsists; and the wings clear, with neuration bright pink except on costal margin, where the nervures of apical portion of wing and a narrow strip of membrane close to edge of costa are pale greenish-yellow. When resting on cane leaves it usually remains motionless on the approach of danger, preferring to trust to protective colouration rather than its limited powers of flight.

The female is about $1\frac{1}{2}$ inches long, with a wing expanse of $2\frac{1}{4}$ inches, the male being much smaller.

This common locust attacks young plant and ratoon suckers, and is a well-known cane pest in Java.

(15) **OXYA VELOX**, Fab. (Family ACRIDIIDAE).

Plate III., Fig. 15, p. 20.

Occasions injury to the foliage but is somewhat sparingly distributed and by no means a serious pest.

The adult female, which is much larger than the male, measures $1\frac{1}{4}$ inches in length by nearly 2 inches across the extended tegmina, which are pale brownish-green and broader on basal than central portions, as indicated in photo. (Plate III., Fig. 15). Wings clear. Head, sides of thorax, and femora of legs greenish-yellow; tibiae and tarsi light blue. Antennae pale pinkish-brown shaded into dark brown towards tips. The general colouration of this species renders it inconspicuous whilst feeding.

Like the preceding, it has also been recorded as destructive to sugarcane in Java.

(16) **CYRTACANTHACRIS ? PROXIMA**, Walk. (Family ACRIDIIDAE).

Met with rather sparingly among cane at Gordonsvale, where it is no doubt responsible for minor injuries to the foliage. This grasshopper, which is referred provisionally to genus *Cyrtacanthaeris*, is of moderate size, measuring about $3\frac{1}{4}$ inches in expanse, and having light-brown wing-covers marked with four unequal sized conspicuous reddish-brown blotches on basal and central portions, and a number of much smaller rather indistinct fainter markings scattered over apical area.

Wings very light brownish-yellow.

(17) **CYRTACANTHACRIS PLAGIATA**, Walk. (Family ACRIDIIDAE).

(18) **CYRTACANTHACRIS GUTTULOSA**, Walk. (Family ACRIDIIDAE).

These two locusts are classed as cane pests in our Brisbane collection of economic insects at the Agricultural Department, but up to the present have not been met with at Gordonvale.

Both are active representatives of the genus, and measure nearly 2 inches in length, with a wing expanse of about 4 to 4½ inches.

(19) **CIRPHIS UNIPUNCTA**, Haw. (Family NOCTUIDAE).

Plate I., Fig. 19, p. 6.

Most growers are familiar with the caterpillars of this celebrated pest, which are more or less in evidence each season, and strip the young foliage at night-time, usually concealing themselves by day in the centre of affected plants amongst unfolding leaves.

These destructive larvæ sometimes travel through a district in a vast army, devouring nearly everything before them and often entirely consuming valuable cereal and other cultivated crops. The last serious outbreak of this sort occurred in the Cairns and Mossman districts during 1912.

Fortunately, numerous natural enemies in the shape of birds, parasitic insects, and infectious diseases succeed in keeping them within reasonable bounds.

Tryon figured and described four hymenopterous and a dipterous parasite of unipuncta in *The Queensland Agricultural Journal*, vol. 6, p. 135; and doubtless many other native parasitic and predaceous enemies await discovery.

The writer recently bred a tiny tachinid fly from larvæ collected near Gordonvale last October.

The following very brief description of this parasite may interest entomologists:—Thorax silvery-gray, several long slightly curved black spines on sides; annulets white and very large. Abdomen black, anterior margins of segments silvery, sides and extremity bearing a number of stout black spines. Body sparingly furnished with stout black hairs. Legs black, and spined. Head dull yellow above antennæ, face silvery, spined on forehead and close to proboscis. Antennæ dark yellowish-brown. Length, 3.60 mm.

(20) **PARUARA MATHIAS**, Fab. (Family HESPERIDAE).

Plate III., Fig. 20, p. 20.

Larval specimens of this insect were observed damaging the foliage of sugar-cane at Harvey's Creek in December, 1914.

Like other closely related species, the larva feeds under cover, drawing together the edges of a leaf-blade in such manner as to form an almost cylindrical tube in which it is effectually hidden, and comparatively safe from the attacks of birds and other foes.

Description of Caterpillar.

General colour, pale sea-green, with three faint but darker green dorsal stripes, the subdorsal ones edged below with light yellow. Anal segment pale bluish-green, extremity of dorsal portion semi-circular and edged with white hairs.

Head green with a conspicuous reddish-brown oblique stripe across centre of eye bordered on each edge with whitish. Sides of body whitish just below spiracles. Mandibles white with cutting edge straight, bordered with black, and not toothed. Length, 36 mm. (about $1\frac{3}{8}$ inches).

Before pupating the larva forms an elongate, open, boat-like cavity by bending upwards in the shape of a quarter circle opposite edges of a leaf-blade, holding same in that position by two or more tough strands made of many thicknesses of silk twisted together. These cords, which bridge the hollow transversely, are generally placed about 1 inch apart, and attached to the edges of the leaf. Transformation takes place in the hollow thus formed, the pupa lying fully exposed to view just below the silken strands, with tail-end affixed by anal hooks to a mass of threads and its body secured to the surface by a strong silk girdle crossing the centre of dorsal surface of thorax obliquely, and fastened to the leaf on either side.

Description of Pupa.

Pale whitish-green, matching the foliage, suffused with delicate pinkish-white at extremities, and with four faint white longitudinal dorsal lines on abdominal segments. Front of head produced into an elongate conical point. End of anal segment flattened, plate-like, hollowed ventrally, and rounded at extremity. Length, 30 mm. (about $1\frac{1}{8}$ inches). The pupal stage occupies eleven days under an average shade temperature of 81-50 F.

Notes on Imago.

This common hesperid has a wide range of flight, extending from Port Darwin to Brisbane, and occurs also on sugar-cane in other countries.

The butterfly is of a uniform dark smoky-brown tint, with body and basal half of upper wing surface densely covered with long glossy yellow hairs. The arrangement of spots on fore-wings is shown on Plate III., Fig. 20; and the hind-wings, which are characterised by a slight prolongation of their rounded anal angles, are greenish-yellow

beneath, with a row of three small white spots near outer angle. Wing expanse, 40 mm. (about $1\frac{1}{2}$ inches).

A braconid parasite was bred by us last December from a larva of this "skipper."

(21) **TELICOTA AUGIAS-KREFFTI**, Macl. (Family HESPERIDAE).

Plate III., Fig. 21, p. 20.

Observed damaging cane leaves at Babinda about the middle of December, the habits of the larva being very similar to those of the foregoing species.

Description of Caterpillar.

Grass-green, dorsal pulsating line darker green. Hinder half of each abdominal segment ridged transversely and yellowish. Dorsal surface of anal segment plate-like, very roughened, and blotched with shining black; extremity of same semi-circular, edged with a few white hairs. Head dark greenish-brown, deeply punctate; antennae white; mandibles and a V-shaped mark on face blackish.

Description of Pupa.

Thoracic segments, wings, and dorsal surface of abdominal segments dark reddish-brown. Ventral surface of abdomen and hind borders of dorsal surfaces of abdominal segments dull greenish-yellow. Head nearly width of prothorax. Anal segment terminating in a flattish nearly square dark-red plate, with posterior edge straight and fringed with a number of hooked spines. (Plate III., Fig. O.) Body covered with short stiff yellowish hairs and integument much roughened. Length, 20 mm.

The pupal stage during December lasts about ten days. Unlike that of the preceding insect, the pupa is hidden from view in the feeding-tube of caterpillar.

Notes on the Imago.

This well-known skipper, which is met with from Sydney to Thursday Island, has been recorded as a cane pest in Java, and occurs also in India, New Guinea, &c.

The colouration of wings on upper surface is bright orange-yellow variegated with dark smoky brown, in manner illustrated on Plate III., Fig. 21. Body black, ornamented with golden hairs forming bars across the abdomen. Lower surface of wings uniform light golden-yellow except on hind margin, anal portion of outer margin, and base of fore-wings, which are blackish. Wing expanse varying from 28-33 mm.

A tiny hymenopterous parasite was bred at Gordonvale last May from eggs of this species.

(22) **PADRAONA MARNAS**, Feld. (Family HESPERIDAE).

Plate III., Fig. 22, p. 20.

Larvæ of this butterfly were collected on sugar-cane at Babinda towards the end of November, 1914, inflicting damage identical in character with that caused by the foregoing hesperids.

Description of Larva.

Dull pale greenish-yellow, with obscure gray dorsal pulsating line. First thoracic segment with a dark-brown transverse line above spiracles interrupted on centre of back. Dorsal surface of anal segment forming a dull yellow roughened plate, having a very conspicuous black elongate blotch on each side and edged with yellow hairs. Ventral surface pinkish. Head yellowish-brown covered with pustules; eyes contiguous nearly to centre of face, margined behind and in front of face with dark red; mandibles dark-red, edged with black. Length, 31 mm. (about $1\frac{1}{4}$ inches); width, 4 mm.

A caterpillar kept in confinement pupated on the 19th December, the butterfly emerging on the 28th of same month (nine days later).

Description of Pupa.

The pupa differs from those of the preceding species in the structure of its anal segment, the extremity of which is cleft vertically and produced dorsally in the form of a plate-like ridge bearing four short stout spurs. (See Fig. P, Plate III.) Both dorsal and ventral faces of this plate are hollowed, the former very remarkably. Terminal abdominal segments supporting numerous short bristly reddish hairs. Length, 22 mm.

Notes on the Imago.

General colouration of upper surface resembling that of *T. augias-krefftii*, but differing in arrangement of markings as shown in Figs. 21 and 22, Plate III. Undersurface of hind-wings occupied in centre by a large orange-yellow patch showing through from upper surface; rest of wing light brownish-yellow; fore-wing dark-brown, except on apical and central portions.

(23) **CHUSARIS RHODIAS**, Turner. (Family NOCTUIDAE).

Plate III., Fig. 23, p. 20.

The caterpillars were observed eating cane leaves in company with *Cirphis unipuncta* near Gordonvale on 2nd September, 1914.

Description of Caterpillar.

General colour on upper surface light creamy-yellow, paler posteriorly, with irregular reddish-brown centro-dorsal and sub-dorsal

lines, the latter and a band below spiracles being usually paler and more broken than centro-dorsal stripe. Dorsal area occupied by more or less detached zig-zag markings and dots of same colour arranged roughly to form four longitudinal bands. Ventral surface and prolegs whitish with a broken central stripe consisting of detached reddish-brown blotches on four posterior abdominal segments between legs. Each body segment supporting ten or more brown hairs arising from black tubercular dots, more noticeable on terminal posterior segments and prolegs. Head and first thoracic segment very pale yellow, the former with two brown longitudinal V-shaped marks extending in four lines across whole of dorsal surface. Labrum and base of mandibles white, the points of latter dark brown, toothed. Body tapering towards tail end which terminates in the extended points of anal prolegs. Length, 35 mm.

(24) **HARMOLOGA (MISERANA, Walk. ?)** (Family **TORTRICIDAE**).

Plate III., Fig. 24, p. 20.

This species was found damaging young ratoons at Pyramid towards the end of October, 1914.

The larva feeds openly, but constructs a hiding-place by affixing to the leaf-blade an oblong shaped piece of cane leaf in the form of a slightly convex shield, under which it retreats when alarmed.

Description of Caterpillar.

Dorsal surface of first thoracic segment covered with a shining pale yellow plate rounded behind; second thoracic segment dark claret-red; third thoracic and abdominal segments whitish with a smoky-brown irregular centro-dorsal line, each segment having two large subdorsal light claret-coloured blotches, two suffused more or less distinct pale-brown transverse blotches between them on dorsal area, and four pearl-like pustules, each supporting a single white hair. Anal segment with a pearly-yellow dorsal plate carrying a number of long white hairs. Ventral surface and claspers greenish-white, prolegs black. Head large, light red. Body tapering slightly towards tail extremity. Length, 18 mm. A specimen kept in confinement pupated on 3rd December, the perfect insect emerging eight days later.

Notes on the Imago.

The moth is obscurely coloured—silvery-gray on upper surface with a few irregular small brown spots on the fore-wings, and hinder pair suffused with delicate silvery-brown. Wing expanse, 17 mm. At present it is of little or no economic importance.

(25) **EUPROCTIS HOLOXUTHA**, Turner. (Family LIPARIDAE).

Plate I., Fig. 25 and H, p. 6.

Discovered eating leaves of sugar-cane in December, 1914.

Colouration of Moth.

Wing membrane whitish, semi-transparent, sparingly sprinkled with short hairs and large golden-yellow scales of curious shape, figured at H, Plate I. Nervures yellow, very conspicuous, hairy. Head, thorax, and basal portions of wings thickly covered with long fluffy yellow hairs. Wing expanse, 33 mm. (about $1\frac{3}{8}$ inches). Presumably unimportant. A related species, *Euproctis minor*, Snell., is known to attack sugar-cane in Java.

Plant-Eating Beetles.

Four species of the family Chrysomelidæ are found more or less commonly on the foliage of cane plants at Gordonvale, but only one of these (*Rhyparida morosa*, Jac.) was observed to cause appreciable damage. Our annual bush fires extending over vast areas of forest land probably operate as a natural check on the increase of chrysomelid beetles by destroying their food-plants, together with multitudes of the adult insects.

(26) **RHYPARIDA MOROSA**, Jac. (Family CHRYSOMELIDAE).

Plate III., Fig. 26 Q-R., p. 20.

General colour uniform shining black, occasionally with a bronze tint. Head deeply immersed in the prothorax up to the eyes. Antennæ reddish-brown with eleven joints of about equal length, the first five lighter in colour, more slender, and less hairy than the remainder.

Prothorax and elytra punctate, the former irregularly and finely, the latter coarsely with punctures arranged in curved lines as shown on drawing. Scutellum semi-circular. Length, 6 mm. ($\frac{1}{4}$ inch); greatest width, 4 mm.

Its native food-plant, the so-called "blady grass" (*Imperata arundinacea*) is abundant at present, but possibly in course of time, as cultivation extends, this beetle may become troublesome, it having already acquired a decided liking for sugar-cane. It usually occurs on borders of plantations adjoining "blady-grass" country, sometimes very plentifully. The imago is victimised by a predaceous bug belonging to the family Reduviidæ.

- (27) **COLASPOSOMA SELLATUM**, Baly. (Family CHRYSOMELIDAE).

Plate III., Fig. 27 s-t., p. 20.

A variable and rather local species of uniform iridescent metallic golden-green, coppery-brown, or dark greenish-purple colour. Eyes black, rather prominent; antennæ dark reddish-brown, joints 7-11, larger and darker than the preceding. Body stout, very convex above, and covered with tiny punctures arranged roughly in two or more rows on each side of suture, but irregularly elsewhere. Scutellum shield-shaped. Length, 7.30 mm. (slightly exceeding $\frac{1}{4}$ inch); width, 4.50 mm.

- (28) **RHYPARIDA** (var. of **HASIPENNIS**, Lea ?) (Family CHRYSOMELIDAE).

Plate III., Fig. 28, p. 20.

This is a small species about $\frac{1}{8}$ of an inch long, with head and thorax light reddish-brown, elytra black with longitudinal rows of punctures; and legs and antennæ yellowish. It feeds commonly on the foliage of the Brown Kurrajong (*Commersonia echinata*).

- (29) **RHYPARIDA DIDYMA**, Fab. (Family CHRYSOMELIDAE).

Plate III., Fig. 29, p. 20.

An attractive shining light yellowish-brown beetle with reddish head and thorax. Antennal joints 5-11, eyes, tarsi, and distal ends of femora and tibiae black. Each elytron slightly hollowed irregularly near its base on dorsal surface, and with about twenty-two rows of fine punctures; margins of suture, outer apical edges, and three or more conspicuous very irregular blotches black. Length, 8.70 mm. (nearly $\frac{3}{8}$ inch); width, 4.90 mm. Not uncommon on the foliage of the "Sugar-grass" (*Sorghum halepense* Pers.).

- (30) **STENOCORYNUS ARIDUS**, Pas-e. (Family CURCULIONIDAE).

Plate III., Fig. 30 and v., p. 20.

A somewhat slender-bodied weevil of a general silvery-yellow colour, marked with a broad suffused blackish band down centre of prothorax, and seven narrower longitudinal indistinct stripes associated with several parallel rows of black punctures on elytra. By the aid of a pocket lens the entire body and legs are seen to be densely covered with minute scales. Length, 10.60 mm. ($\frac{3}{8}$ of an inch); greatest width, 4.20 mm. Occurs freely on the foliage of *Urena lobata* and other common plants.

Section D.—Sap-Sucking Insects.

- (31) " Leaf Hopper " (*Tetigonia parthaon*, n. sp., Kirk.).
- (32) " Leaf Hopper " (*Perkinsiella saccharicida*, Kirk.).
- (33) " Plant Louse " (*Aphis sacchari*, Zehn.).
- (34) " Plant Louse " (*Aphis adusta*, Zehn.).
- (35) " Plant Louse " (*Aphis* sp., ?).
- (36) " Plant Louse " Bud Aphidid.
- (37) " Snow Fly " (*Aleurodes berghi*, Sign.).
- (38) " Mealy Bug " (*Pseudococcus calceolariae*, Mask. ?).
- (39) Scale Insect (*Ripersia* ? sp. ?).

(31) **TETIGONIA PARTHAON**, n. sp., Kirk (Family TETIGONIDAE).

Plate III., Fig. 31, p. 20.

(32) **PERKINSIELLA SACCHARICIDA**, Kirk. (Family ASIRACIDAE).

Both the above species appear to be well controlled by various parasitic and other enemies, and although common enough in our cane-fields do not call for repressive measures. The former leaf-hopper habitually frequents the crown of the plant, hiding between the unfolding heart leaves and not readily jumping or taking flight when disturbed.

(33) **APHIS SACCHARI**, Zehn. ? (Family APHIDIDAE).

This species may generally be found during hot weather congregating on the under surface of cane leaves. It is plentiful at Gordonvale, but apparently kept in check by several predaceous and parasitic insect enemies, six of the former class having been observed (June, 1915) on a few stools of infested cane growing at the Laboratory, viz.:—2 species of Coccinellidae, 2 of Hemerobidae, and 2 of Syrphidae. During the Spring of 1915, however, these aphides proved locally injurious to plant cane that had suffered loss of vitality owing to long-continued dry weather.

Larva.

Very pale green; of somewhat chalky appearance. Head sometimes inclined to flesh colour.

Apterous Viviparous—Female.

Pale yellowish-green, with abdominal dorsal surface sometimes slightly blotched with irregular markings and spots of dark brown. Nectaries, tail, 6th and 7th antennal segments, and tarsi black. Eyes dark red.

Winged Viviparous—Female.

Head, antennæ, mesothorax, and nectaries dark brown; pro- and metathoracic segments lighter yellowish-brown. Neck and abdomen pale greenish-yellow, the latter barred transversely with light brown on

dorsal area, the three central bars usually of about equal length, broader, and closer together than the others. Sides of basal portion of abdomen with from three to five light brown spots. Nectaries small, slightly swollen centrally, base and mouth about same width, the latter distinctly rimmed. Legs pale yellow, mid and hind femora light brown, tarsi and distal ends of tibiae black. Antennae about two-thirds as long as body; 5th segment slightly longer than 4th; 3rd longer than 5th, but much shorter than 7th. Wing venation normal, nervures black, strongly shaded. Length, 1.10 mm. Wing expanse, 4.15 mm.

(34) **APHIS ADUSTA**, Zehn. (Family APHIDIDAE).

Recorded by Tryon in 1905 as affecting Badila cane at Bingera. This species has long been recognised as a cane pest in Java.

(35) **APHIS**, sp. (Family APHIDIDAE).

Plate IV., Fig. 35, p. 34.

Larva.

Rather slender bodied; pale green suffused with bluish-grey on head and prothorax. Eyes and nectaries dark red, the latter arising from the centre of a light bluish-brown blotch; antennae about one-third length of body; rostrum reaching as far as intermediate coxae, reddish on basal portion. Legs and 6th and 7th antennal joints light brown. Length, 0.70 mm.

Nymph.

Light green, somewhat whitish in parts. Head and prothorax purplish-brown, the latter with two dark brown dorsal blotches. Nectaries dark red surrounded by a light brown blotch. Rostrum reaching midway between anterior and intermediate coxae, base reddish, point black. Eyes red; antennae light yellow, less than half length of body; 6th and 7th joints brown, 1st considerably longer than 2nd; 3rd about length of 7th. Wing pads and tail brown, the latter short, triangular, obtuse. Legs brown except on anterior femora and basal portions of hind and intermediate femora and tibiae. Length, 1.80 mm.

Winged Viviparous—Female.

Head and thorax dark greenish-brown; abdomen uniform pale green. Antennae brown, imbricated, less than two-thirds length of body; 3rd joint longer than 7th, with twenty-two sensoria; 4th, 5th, and 6th joints about equal length, 4th with five, 5th with three sensoria. (*See* Plate IV., Fig. 35-x.). Rostrum not reaching to intermediate coxae. Nectaries dark brown, slightly swollen in middle, mouth distinctly rimmed. Tail long, conical, tip white and woolly looking. Legs dull yellow, hairy, with tarsi and distal half of femora and tibiae greenish-brown. Wing

nervures light yellow; cubital vein twice forked, the second fork very small, situated at end of branch close to apical margin and occasionally absent. Wing expanse, 4.85 mm. Length of body, 1.60 mm. Occurring on sugar-cane leaves at Pyramid during September, 1914.

(36) **BUD APHIDID.** (Family APHIDIDAE).

Plate IV., Fig. 36 and v., p. 34.

A large globular dull yellow aphid was noticed on several occasions during late Winter and early Spring months clustered in small colonies at the bases of cane shoots or on the swelling buds of "sets" planted about 4 inches deep. It was invariably attended by ants and sometimes associated with "mealy bugs" (*Pseudococcus* sp.). Winged forms were unobtainable, and no specimens were observed on young stems or foliage above ground. This insect is probably new to science, no subterranean species of similar habit having, I believe, been hitherto recorded as affecting cane.

Description of Larva.

Elongate, hairy, pale orange-yellow slightly darker on dorsal margins of body. Rostrum reaching nearly to end of abdomen. Antennæ short, stoutish, 4-jointed, 4th joint longer than remainder taken together. Extremity of rostrum, tarsi, and antennæ blackish. Legs short, stout. Length of body, 0.65 mm.

Description of Viviparous Female.

Rotund, nearly spherical viewed from above, hairy, dull orange colour, dusted with white powdery secretion. Abdomen much wider than thorax with dorsal marginal edges depressed, tail conspicuous, and obtusely conical. Head small, eyes nearly obsolete, consisting of about four dark red ocelli. Rostrum not reaching beyond posterior coxæ. Antennæ and legs short, stout; the former not reaching to metathorax, 4-jointed (*see* Plate IV., Fig. V.), 4th joint slightly longer than 2nd and 3rd taken together, 3rd joint clavate. Length of body, 1.40 mm.

(37) **ALEURODES BERGHI**, Sign. (Family ALEURODIDAE).

Plate IV., Fig. 38, p. 34.

This insect was first noticed by the author last November, and the following June (1915) many adult females were observed busily engaged in laying eggs on the foliage of sugar-cane growing at the Experimental Laboratory. Later, during October, part of a field of young plant cane near Gordonvale was very noticeably infested, and slightly damaged by this pest. Winged forms of both sexes were present as well as

millions of eggs, larvæ, and pupæ. I believe our Queensland aleurodid to be identical with *A. bergii*, Sign., a well-known species affecting cane elsewhere.

(38) **PSEUDOCOCCUS** (**CALCEOLARIAE**, Mask. ?) (Family COCCIDAE).

Plate IV., Fig. 37, p. 34.

Most canegrowers are familiar with these peculiar soft-bodied insects that appear to have been dusted over with flour, and are so frequently met with under the older leaf-sheaths, etc., of standing cane.

Our common "mealy-bug" is thought to be identical with *P. calceolariae* of Maskall, a large pinkish-coloured species that affects cane in other countries. In Hawaii, however, a mealy-bug of similar appearance to the Australian one, and that has until quite lately been known as calceolaride, is now considered by Ehrhorn to be *Pseudococcus sacchari*, so that possibly our sugar-cane coccid may not after all be the former insect. Fortunately this pest, although extremely prolific, is efficiently controlled by various natural enemies and under normal conditions unlikely to occasion serious damage.

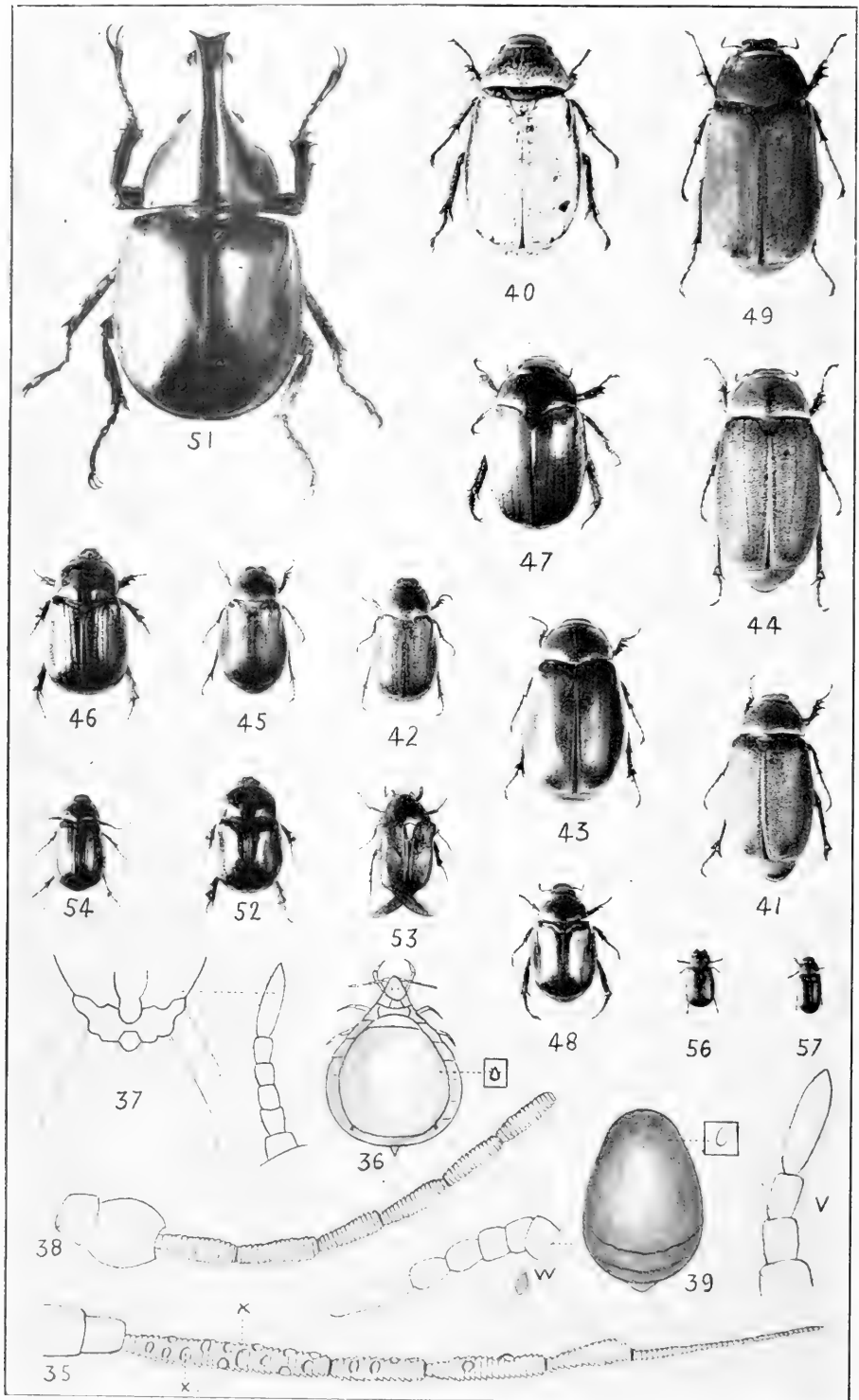
(39) **RIPERSIA**, ? sp. (Family COCCIDAE).

Plate IV., Figs. 39 w., p. 34.

Occurs somewhat sparingly in canefields, several specimens having been found recently near Gordonvale and at the Laboratory affecting the roots and underground buds of "sets." The adult female varies much in shape, being often packed tightly in irregular crevices between expanding buds, etc. Like the well-known "Nut Grass Coccid" (*Antonia australis*) it is more or less enveloped by a crust composed of a yellowish-white felted secretion, but differs from that insect in being dark purplish-brown instead of black and in the absence of conspicuous tubercles and hairs on the anal segment. The young larva, which is elongate oval and dark brown above, margined with dull yellow, is covered with minute excrescences and possesses a very long hair-like rostrum and 6-jointed antennæ. (See Fig. W.) Length of body, 0.60 mm. When touched, these curious scale insects emit a tiny globule of clear sugary fluid that is greedily devoured by a small golden ant usually in attendance, and which, in return for such sweet morsels, protects them from the attacks of various insect enemies.

PLATE IV.

- Fig. 35—Antenna of *Aphis* sp. (highly magnified ; original).
- Fig. 36—Viviparous female of “ Root Aphis ” (natural size and enlarged).
v.—Antenna of same (magnified ; original).
- Fig. 37—“ Mealy Bug ” ; end of abdomen, and antenna of larva of same (highly magnified ; original).
- Fig. 38—*Aleurodes berghi*, Sign. “ Snow Fly ” Antenna of female of (highly magnified ; original).
- Fig. 39—Scale Insect (*Ripersia* sp. ?) (natural size and enlarged ; original).
w.—Antenna of same (magnified).
- Fig. 40—“ Mealy Backed Cockchafer,” *Lepidiota albohirta*, Water. (natural size ; Q. Dep. Ag.).
- Fig. 41—Cane Beetle, *Lepidiota frenchi*, Blackb. (natural size ; Q. Dep. Ag.).
- Fig. 42—Cane Beetle, *Lepidiota rothei*, Blackb. (natural size ; Q. Dep. Ag.).
- Fig. 43—Cane Beetle, *Lepidiota caudata*, Blackb. (natural size ; Q. Dep. Ag.).
- Fig. 44—Cane Beetle, *Lepidiota* sp. No. 683 (natural size ; Q. Dep. Ag.).
- Fig. 45—Cane Beetle, *Lepidiota* sp. No. 215 (natural size ; Q. Dep. Ag.).
- Fig. 46—Cane Beetle, *Dasygnathus australis-dejeani*, Macl. (natural size ; Q. Dep. Ag.).
- Fig. 47—“ Christmas Beetle,” *Anoplognathus boisduvali*, Boisd. (natural size ; Q. Dep. Ag.).
- Fig. 48—Cane Beetle, *Anomala australasiae*, Blackb. (natural size ; Q. Dep. Ag.).
- Fig. 49—Cane Beetle, *Lepidiota froggatti*, Macl. (natural size ; Q. Dep. Ag.).
- Fig. 51—“ Elephant Beetle,” *Xylotrupes australicus*, Thomp. (natural size ; Q. Dep. Ag.).
- Fig. 52—Cane Beetle, *Isodon puncticollis*, Macl. (natural size ; Q. Dep. Ag.).
- Fig. 53—Chaffer Beetle, *Cacachroa decorticata*, Macl. (natural size ; Q. Dep. Ag.).
- Fig. 54—Cane Beetle, *Haplonycha* sp. ? (natural size ; Q. Dep. Ag.).
- Fig. 56—Cane Beetle, *Epholcis bilobiceps*, Fair. (natural size ; Q. Dep. Ag.).
- Fig. 57—Cane Beetle, *Heteronyx* sp. (natural size ; Q. Dep. Ag.).



E. Jarvis, Del. Q. Dep. Ag. Photos.

PLATE IV.

Insects affecting the Roots of Sugar Cane.

Section E.—Insects Devouring the Roots.

Under the above heading are placed the various kinds of root-eating Scarabaeidae known to attack sugar-cane at Gordonvale, including our worst offender in this respect, the notorious Grey-backed or Mealy-backed Cockchafer, that is justly regarded as a standing menace to the prosperity of a great industry. This section may be conveniently subdivided into two classes, comprising (1) beetles known to be eminently destructive or likely to become serious pests; and (2) species of little or no present economic importance.

Class I.—Notably Injurious Species.

- (40) "Mealy-backed Cockchafer" (*Lepidiota albohirta*, Waterh.).
- (41) Cockchafer Beetle (*Lepidiota frenchi*, Blackb.).
- (42) Cockchafer Beetle (*Lepidiota rothei*, Blackb.).
- (43) Cockchafer Beetle (*Lepidiota caudata*, Blackb.).
- (44) Cockchafer Beetle (*Lepidiota* sp. No. 683).
- (45) Cockchafer Beetle (*Lepidiota* sp. No. 215).
- (46) Dynastid Beetle (*Dasygnathus australis-dejeani*, Mael.).
- (47) "Christmas Beetle" (*Anoplognathus boisduvali*, Boisd.).
- (48) Rutelid Beetle (*Anomala australasiae*, Blackb.).

(40) **LEPIDIOTA ALBOHIRTA**, Waterh. (Family MELOLONTHIDAE).

Plate IV., Fig. 40, p. 34.

Description of Beetle.

Deep brown, thickly covered, except on legs and central area of abdominal segments, with minute white sharply pointed pear-shaped scales, not placed in punctures but lying on the surface of the elytra and readily detachable. Freshly emerged specimens are uniformly gray and mealy-looking, but after a few days become more or less rubbed, the portions of denuded surface showing as irregular brown blotches. Head, anterior edge, and venter of prothorax, coxae, and legs sparingly furnished with dull yellow hairs. Antennal club of male 6-jointed; of female 5-jointed.

Natural Insect Enemies.—(1) "Digger Wasp" (*Dicles formosus*, Guerin); (2) "Digger Wasp" (*Campsomeris radula*, Fab.); (3) "Digger Wasp" (*Discolia soror*, Smith); (4) Parasitic fly (*Tachinidæ* sp.); (5) Parasitic fly (*Muscida* sp.) attacking the adult beetle; (6) Predaceous larvæ of an Elaterid beetle (*Agrypus mastersi*).

NOTES ON METHODS OF REPRESSION.

The following notes summarise various phases of experimental work relating to the control of this insect published from time to time in progress reports.

Light Traps.

As a result of research conducted during November and December, 1914, it was found that both sexes are readily attracted to acetylene light

throughout their aerial existence, such reaction being governed by various meteorological and other conditions. Flight commences at dusk, but specimens do not enter the traps until 8 p.m. (45 minutes later) when all signs of daylight have disappeared. The table given below records results obtained on three consecutive evenings by a trap specially designed by the writer for this branch of control.

Sky clear; no wind; no moon.					<i>Lepidiota albohirta</i> , Wate.			
Date.		Average Temperature.		Hours.	Beetles Caught.	Male.	Female.	
Dec. 14	..	76° F.	..	8 p.m. to 11 p.m.	..	51	40	11
Dec. 15	..	76° F.	..	8 p.m. to 9 p.m.	..	57	46	11
Dec. 16	..	77° F.	..	8 p.m. to 10 p.m.	..	62	45	17
						170	131	39

Total figures represent the result obtained in six hours by a single trap placed among plant cane, and illuminating about one cardinal point of the compass, at a time when the first brood of beetles were emerging.

It is important to note in this connection that an interval of three weeks elapses between the acts of emergence and oviposition, and that the beetles do not as a rule all leave the ground on the same date. The primary brood usually issues from ploughed land towards the end of November, appearing first in localities where land is of a light character and a week or so after on red volcanic and heavy soils. Finally, an emergence may occur still later from unploughed forest country. Thus it becomes apparent that the individual grower may be called upon to deal with two lots of *albohirta* arising at different times from cultivated and forest lands, in which case the period preceding oviposition—the only profitable time for using light traps—would necessarily be prolonged for a month or even six weeks, dating from the first appearance of the beetles.

Stomach Poisons for the Beetle.

During February (1915) experiments were instituted to test the insecticidal effect of lead arsenate and other chemicals when applied to favourite food plants. Results may be briefly stated as follows, figures referring to days to be taken in each case as being average numbers:—Arsenate of lead, 2 lb., mill molasses, 1 lb., in 50 gallons of water, proved fatal after nine days to beetles consuming about half a square inch of poisoned leafage. A similar proportion of arsenate with the addition of ½ lb. soap killed in ten and a-half days, the latter ingredient seemingly being less palatable than molasses, as although in this case 62 beetles were employed, they consumed only 24 square inches during a longer period. Stronger arsenate-molasses solutions were found less effective, 3-50 and 4-50 strengths taking ten days to kill, while the proportion of poisoned leafage devoured by the 52 beetles used amounted to about half that of shoots treated with 2-50-1 molasses formula.

Control specimens, 30 in all, feeding on unsprayed leaves lived for fourteen days, and did not eat more food proportionately than beetles confined with poisoned foliage.

Barium chloride 2 per cent. solution (6 lb. to 30 gallons water) gave negative results, and apparently made foliage distasteful.

Deterrents for Cane-grubs.

An account of initial experiments carried out for the purpose of determining the deterrent qualities of dichlorbenzole was published in April, 1915 (*Australian Sugar Journal*, vol. 7, p. 214). Land treated with $\frac{1}{4}$ -oz. injections became after nine days sufficiently impregnated to drive away or kill all grubs located within a distance of 8 inches from the chemical. In dry weather a quarter of an ounce, after being fifteen days underground at a depth of 7 inches, subjected to an average temperature of 69 degrees Fahr., weighed 3 scruples 5 grains, thus indicating a loss of nearly 50 per cent., but did not actually disappear until the end of six weeks. Better results could, doubtless, be obtained from injections made of a single lump, like a "moth-ball," as in this form the same amount of chemical might last two months or longer. Under wet conditions both evaporation and soil infection were retarded.

It is worth noting, however, that the deterrent odour remains in the ground long after all traces of its origin have vanished. Soil under cane stools treated 5th March was found to be strongly infected on the 8th of May, three weeks after complete evaporation, from which we may reasonably assume that a limited area of such contaminated soil—comprising, say, a strip at least a foot wide—would continue repellent until the odour became less decided.

(41) **LEPIDIOTA FRENCHII**, Blackb. (Family MELOLONTHIDAE).

Plate IV., Fig. 41, p. 34.

This widely distributed and very abundant insect breeds in unbroken forest land but is frequently found in canefields and is at times responsible for considerable damage.

Some idea of its excessive numbers may be gathered from the fact that last January (1915) four collectors in half an hour picked off no less than 10,925 of these beetles from the fence of Gordonvale Recreation Reserve, in the centre of the township.

A thick growth of weeds is likely to induce attack and should never be allowed to occupy plantations or land intended for cane during the period when this species is ovipositing.

Description of Beetle.

Dull whitish-red, finely and rather closely punctate on dorsal surface, each puncture containing a single white, nearly circular scale. Sides of prothorax acute with edge dark red, turned up and symmetrically

scalloped. Lower edges of hind margin of same bordered densely with scales. Edges of suture slightly emarginate. Ventral surface and legs more or less thickly clothed with white scales, which on abdomen are circular and absent on anterior edges of segments, and minute on sides or body; but on thoracic plates vary from round to pear-shape and in the vicinity of coxæ are replaced by long silvery hairs. Length, 24 mm. (nearly 1 inch).

Natural Enemies.—A dextiid fly (undetermined) bred March, 1915.

(42) **LEPIDIOTA ROTHEI**, Blackb. (Family MELOLONTHIDAE).

Plate IV., Fig. 42, p. 34.

A fairly plentiful species, occurring sparingly in canefields.

Description of Beetle.

Dark shining reddish-brown, appearing to the naked eye slightly whitish on dorsal surface owing to the presence of innumerable fine punctures, each containing a single waxy-looking pear-shaped scale. Ventral area and legs more or less densely clothed with light-gray scales except on tarsi and anterior margins of abdominal segments. Length, 17.50 mm. (nearly $\frac{3}{4}$ of an inch).

Natural Enemies.—A dextiid fly (undetermined), bred February, 1915; "Digger-wasp" (*Diclis formosus*), bred December, 1914.

(43) **LEPIDIOTA CAUDATA**, Blackb. (Family MELOLONTHIDAE).

Plate IV., Fig. 43, p. 34.

Grubs of this beetle are not uncommon in canefields, and being fully as large as those of the "gray-back" *albohirta*, capable of inflicting serious damage. *L. caudata* is especially harmful to cane growing near scrub lands, and occurred in great numbers during October, 1915, at Deeral and McDonald's Creek.

Description of Beetle.

Brownish-red, slightly darker than in *L. frenchi*, but not as dark as in *rothei*. Freshly emerged specimens have an opalescent sheen, which, although somewhat transient, affords a useful specific distinction. The dorsal surface is more sparingly and minutely punctulate than in *frenchi*, with the scales, although circular, much smaller. The ventral area differs also in having the centre of abdomen blackish, and almost bare; the scales smaller, ovate or pear-shaped instead of round; and the third tooth at centre of front tibiae much reduced and blunter. Length, 25 mm. (about 1 inch).

(44) **LEPIDIOTA No. 683 (FRENCHI ?)** (Family MELOLONTHIDAE).

Plate IV., Fig. 44. p. 34.

Found occasionally in canefields at Gordonvale and more plentifully at Kuranda. This beetle is thought to be identical with *Lepidiota frenchi*, Blackb. (see Plate IV., Fig. 41), but is certainly larger than that species, and, moreover, possesses structural differences, the teeth of the front tibiae being noticeably more obtuse and its tarsal claws shorter and less acute. Such characters are, however, somewhat unreliable, but other specific distinctions occur in the imago, larval, and pupal stages of this insect. Length, 28-50 mm. ($1\frac{1}{8}$ inches).

(45) **LEPIDIOTA, sp., No. 215** (Family MELOLONTHIDAE).

Plate IV., Fig. 45, p. 34.

Not uncommon in red volcanic soil, and has been taken in canefields.

Description of Beetle.

Slightly larger and darker than *L. rothei*, from which it differs in having smaller and narrower scales, the centre of clypeus more deeply notched, the ventral area of abdomen less densely scaled, and darker legs. In addition to the foregoing distinctions this species has a two years life-cycle, and its larval and pupal stages also differ from those of *rothei*. (See Bull. No. 2 of this Bureau, pages 15 and 38). Length, 19 mm. ($\frac{3}{4}$ of an inch). Acetylene light is very attractive to the adult.

(46) **DASYGNATHUS AUSTRALIS-DEJEANI**, MacL. (Family DYNASTIDAE).

Plate IV., Fig. 46, p. 34.

The frequent occurrence of this abundant species in canefields, coupled with its very extensive range of distribution, entitles it to rank fourth in importance among our Scarabaeidae affecting sugar-cane.

Description of Beetle.

Varying from uniform dark shining brown to black. Elytra striated, with about seven rows of coarse punctures on each elytron. Prothorax apparently smooth, but in reality minutely punctate; simple in females, but with front vertically hollowed in the opposite sex, and produced centro-dorsally into two short obtuse points. Head of male furnished with a short slightly curved horn. Sides and frontal edge of clypeus straight, and directed upwards. Length (about $\frac{3}{4}$ of an inch).

Natural Enemies.—A dextiid (undetermined), bred November, 1914; a dextiid fly (undetermined), bred February, 1915; a dextiid fly (undetermined), bred March, 1915.

(47) **ANOPLOGNATHUS BOISDUVALI**, Boisd. (Family ANOPLOGNATHIDAE).

Plate IV., Fig. 47, p. 34.

Common at times among roots of sugar-cane, occurring in both light and heavy soils, but showing a preference for sandy loams. This beautiful insect, our so-called "Christmas Beetle," is widely distributed in northern and southern portions of Queensland. It responds readily to the attractive influence of artificial light.

Description of Beetle.

Elytra pale creamy-gray with faint green and pink iridescence; edges of suture green; about 20 rows of fine punctures on each elytron, half the number being straight and clouded in places with smoky-brown having the appearance of somewhat broken parallel dotted lines; outer edges of elytra bordered with golden-brown. Head, prothorax, and scutellum metallic greenish-gold, finely punctate. Pygidium bright green edged with blue. Ventral area iridescent coppery-green; thorax, legs, and anterior margins of abdominal segments more or less clothed with short white hairs. Tibiae and tarsi purple. Length, 25 mm. (nearly one inch).

This species ranks about third in economic importance amongst our beetles attacking sugar-cane. (See Bulletin No. 2 of this Bureau for life-history notes).

(48) **ANOMALA AUSTRALASIAE**, Blackb. (Family RUTELLIDAE).

Plate IV., Fig. 48, p. 34.

Description of Beetle.

Uniform deep green with lustrous lighter shades of same colour or of pinkish-bronze. Dorsal surface finely punctate. Legs and venter of thorax sparingly clothed with white hairs. Length, 16 mm. ($\frac{2}{3}$ of an inch). Fairly abundant in canefields.

Natural Enemies.—A tachinid fly (undetermined), bred December and February, 1914-1915; a dextiid fly (undetermined), bred May, 1915.

Class II.—Slightly Injurious Species. Mael.

- (49) Cockchafer Beetle (*Lepidiota froggatti*). ?
 (50) Cockchafer Beetle (*Lepidiota*, sp. No. 666).
 (51) "Elephant Beetle" (*Xylotrupes australicus*, Thomp.).
 (52) Dynastid Beetle (*Isodon puncticollis*, Mael.).
 (53) Chaffer Beetle (*Cacachroa decorticata*, Mael.).

(49) **LEPIDIOTA FROGGATTI**, Mael. (Family MELOLONTHIDAE).

Plate IV., Fig. 49, p. 34.

Several 3rd stage larvæ presumed by Girault to be grubs of this species were found in a canefield at Innisfail, in 1912.

(50) **LEPIDIOTA**, sp., No. 666 (Family MELOLONTHIDAE).

Larvæ recorded from Bundaberg and Childers (July, 1914) occurring under cane stools. Adult unknown. (See Queensland Bureau Sugar Expt. Stations, Division Ent., Bull. No. 2, p. 37).

(51) **XYLOTRUPES AUSTRALICUS**, Thomp. (Family DYNASTIDAE).

Plate IV., Fig. 51, p. 34.

The large grubs of this well-known dynastid, commonly called "Elephant Beetle," feed mostly on vegetable humus, but are accountable at times for minor injuries to cane roots.

Description of Beetle.

Both sexes are of a uniform very deep reddish-black colour, but differ in size and structure, the male as a rule being much larger, with head and prothorax produced into a stout curved horn-like protuberance of variable length, terminating in two prongs, while those of the opposite sex are of simple form, and more coarsely punctate. This species occurs freely in both Queensland and New South Wales, and may often be seen on warm evenings buzzing around electric lights, street lamps, etc. Length of male, about $1\frac{1}{8}$ inches.

(52) **ISODON PUNCTICOLLIS**, Mael. (Family DYNASTIDAE).

Plate IV., Fig. 52, p. 34.

Occasionally attacks cane roots.

Description of Beetle.

Uniform dark shining reddish-brown. Borders of suture forming two slightly raised bands edged by a deep striation. Each elytron with about 12 rows of coarse punctures, not parallel with suture. Prothorax very finely punctate and slightly hollowed horizontally in male just behind frontal edge, the centre of which projects upwards vertically in a single short blunt point. (See also page 16 of this bulletin).

(53) **CACACHROA DECORTICATA**, MacL. (Family CETONIIDAE.)

Plate IV., Fig. 53, p. 34.

Responsible for minor damage to cane.

Description of Beetle.

Uniform shining black, coarsely punctate and marked in most specimens with irregular cream-coloured blotches of variable size arranged in the following order, viz.—two large ones on elytra, one on each side of prothorax, two on pygidium, one on the sides of each abdominal segment against edges of elytra, and one on each side of metathorax close to root of elytron. Length very variable, from 12 to 16 mm. (average size about $\frac{9}{16}$ of an inch). (See Bull. No. 2 of this Bureau, page 43, for data respecting its life-cycle.)

In addition to the above-mentioned Scarabaeidae, at least four species of small Melolonthidae are known to habitually occur among cane roots at Gordonvale, but at present do not cause appreciable injuries.

One of these is a little beetle named *Epholcis bilobiceps* (plate IV., fig. 56), Fair., and the others have been referred provisionally to the genera *Heteronyx* and *Haplonycha* (plates IV., fig. 57, 54; and III., fig. 55).

Glossary of Technical Terms.

Anal	..	..	Hinder extremity of body.
Anal angle	..	..	Hindermost angle of wing nearest to the abdomen.
Annulet	..	..	A tiny white flap observable in a house fly close to root of wing.
Antennæ	..	..	Two slender organs of varying length and form projecting from the head and familiarly termed "feelers."
Anterior	..	..	The foremost or front portion.
Apex	..	..	Pointed extremity of an organ, or sharpest angle or tip of a wing.
Apical area	..	..	That portion of a wing in the vicinity of its apex or tip.
Apterous	..	..	Wingless.
Basal area	..	..	That portion of a wing in the vicinity of its root or base.
Central area	..	..	That portion of a wing lying between its apical and basal portions.
Centro-dorsal	..	..	The centre of the back or upper surface of a body. For example the suture of the wing-cases in a beetle is situated centro-dorsally. (<i>See</i> Plate IV.)
Claspers	..	..	A pair of prolegs attached to the anal segment.
Costal border	..	..	Frontal portion of wing bordering the costal nervure.
Costal nervure	..	..	Usually the strongest vein or nervure of a wing forming its frontal edge. (<i>See</i> C.N., plate I., fig. 2, p. 6.)
Coxæ	..	..	The basal joint of a leg, forming the point of its attachment to the thorax.
Cubital vein	..	..	One of the main nervures strengthening the centre of a wing. (<i>See</i> C.V., plate —, fig. —.)
Diptera	..	..	A group of class Insecta, comprising species possessing only two wings, such as mosquito, blow-fly, March-fly, etc.
Dipterous	..	..	Two-winged.
Distal	..	..	That portion of a leg-joint or other body appendage which is farthest from the point of its attachment.
Dorsal surface	..	..	The back or upper surface of the body. (<i>See</i> "Centro-dorsal.")
Elongate	..	..	Much longer than broad.
Elytra	..	..	Wing-covers or cases, forming the horny back of a beetle.
Excreta	..	..	Matter constituting the excrement or dung of insects.
Femora	..	..	The thickest large joint of a leg, corresponding to the thigh.
Fringes	..	..	A fringe of short hairs or scales occurring on the edges of the wings of a moth or butterfly.
Genus	..	..	An assortment of objects possessing in common many well-marked characters.
Hymenoptera	..	..	A group of class Insecta, including such insects as bees, ants, wasps, &c.

Larva	.. ..	Caterpillar, maggot, or grub.
Lepidoptera	.. ..	A group of class Insecta embracing the moths and butterflies.
Longitudinal	.. ..	Running lengthwise with the body.
Mandibles	.. ..	Jaws for crushing food.
Membrane	.. ..	That portion of the wing stretched between its veins or nervures; transparent in a blow-fly, covered with scales in a butterfly.
Metathoracic - segment		The hindermost of the three segments which, taken collectively, constitute the thorax or chest.
Micro	.. ..	Very small.
Nectaries	.. ..	Two tubular appendages attached to the hind portion of upper surface of abdomen in Plant Lice.
Nervures	.. ..	Veins.
Neuration	.. ..	Arrangement of the nervures in a wing.
Ovate	.. ..	Oval-shaped.
Outer border	.. ..	The marginal portion of a wing lying between its apex and hind angle. (<i>See</i> O.B., plate I., fig. 2, p. 6.)
Palpi	.. ..	Four short thread-like feelers attached in pairs to the lower lip and maxillæ or secondary jaws.
Parasite	.. ..	An insect or other organism which lives on another, known as its host.
Patagia	.. ..	Two flaps covered with hairs or scales situated behind the head on dorsal surface of thorax and covering the roots of the wings.
Pectinations	.. ..	Minute tooth-like serrations arising from the sides of antennæ or other organs.
Porrected	.. ..	Pushed forward prominently and generally horizontally.
Posterior	.. ..	Hinder portion.
Predaceous	.. ..	Living by preying on other animals.
Proctotrypid	.. ..	An insect belonging to the Proctotrypidæ, a family of minute parasitic wasps.
Prolegs	.. ..	The fleshy legs of a caterpillar attached to the hinder portion of its body.
Pronotum	.. ..	A large bonnet-shaped piece of integument which in some insects covers the dorsal surface and a portion of the sides of thorax. (<i>See</i> Pm., plate III., fig. 15, p. 20.)
Prothoracic-plate	.. ..	A portion of skin varying in shape and usually firmer and darker than the rest; often observable in larvæ just behind the head.
Punctate	.. ..	Marked with numerous minute pits.
Puncture	.. ..	A small pit.
Pupate	.. ..	The act of changing into the pupal or chrysalis form.
Rostrum	.. ..	A long hair-like trunk for sucking up fluids.
Scutellum	.. ..	A small hard plate (usually shield-shaped) occurring between the bases of the elytra. (<i>See</i> Sc., plate III., fig. 29, p. 20.)
Sensoria	.. ..	Curious circular openings, observable with a powerful microscope, on the surface of lower antennal joints in Plant Lice. Presumably organs of hearing. (Plate IV., fig. 35, x.x., p. 34.)
Setaceous	.. ..	Tapering very gradually to a point.

Spatulate	..	..	Somewhat spade-shaped.
Species	..	..	An individual organism distinguished from others in the same genus or in related genera by the possession of certain fixed characters constituting specific differences either of form or colouration.
Spiracle	..	..	A small breathing pore plainly observable in the form of a tiny oval ring on the sides of each body segment of a caterpillar.
Sub-dorsal	..	..	That portion of the upper or dorsal surface bordering the centro-dorsal line.
Striation	..	..	An arrangement of scored lines forming tiny channels, usually parallel to each other and placed longitudinally.
Suture	..	..	The line formed by the edges of elytra meeting on centro-dorsal surface of abdomen.
Tachinid	..	..	Belonging to the Tachinidæ, a dipterous family containing parasitic flies.
Tarsal claws	..	..	Claws at the extremity of the foot.
Tarsi	..	..	The feet.
Tegmina	..	..	Wing-covers of a leathery consistency seen in grasshoppers, cockroaches, &c.
Thorax	..	..	The second division of the body, situated between the head and abdomen, and bearing the legs.
Thoracic segment	..	..	One of the three segments which, taken together, constitute the thorax.
Tibiæ	..	..	The shank of the leg between the thigh and foot.
Transverse	..	..	Across; at right angles to an imaginary line drawn longitudinally through the body.
Viviparous	..	..	Producing living young ones instead of eggs.
Wing-cases	..	..	Elytra, or wing-covers, which cover the abdomen of a beetle.
Wing expanse	..	..	The distance from tip to tip of fore-wings when fully extended horizontally. (Plate III., fig. 23, W.E., p. 20.)
Wing-pads	..	..	Rudimentary wings observable as small flaps or pads on the thorax of certain immature forms of insects, such as grasshoppers, bugs, &c.

Index.

(SCIENTIFIC NAMES.)

INSECTS AFFECTING SUGAR-CANE.

Coleoptera (Beetles).						PAGE.
<i>Anomala australasiae</i> , Blackb.	..	..	..	Injuring roots	..	40
<i>Anoplognathus boisduvali</i> , Boisd.	..	..	..	" "	..	40
<i>Cacachroa decorticata</i> , Mael.	..	..	..	" "	..	41
<i>Colaspoma sellatum</i> , Baly.	..	..	..	" foliage	..	28
<i>Dasygnathus australis</i> , Mael.	..	..	..	" roots	..	39
<i>Epholcus bilobiceps</i> , Fair.	..	..	..	" "	..	42
<i>Haplonycha</i> , sp.	..	..	..	" "	..	42
<i>Haplonycha</i> , sp.	..	..	..	" "	..	42
<i>Heteronychus</i> , sp.	..	..	..	" shoots and sets	..	16
<i>Heteronyx</i> , sp.	..	..	..	" roots	..	42
<i>Isodon puncticollis</i> , Mael.	..	..	..	" "	..	41
<i>Lepidiota albohirta</i> , Water.	..	..	..	" "	..	35
<i>Lepidiota caudata</i> , Blackb.	..	..	..	" "	..	38
<i>Lepidiota frenchi</i> , Blackb.	..	..	..	" "	..	37
<i>Lepidiota rothei</i> , Blackb.	..	..	..	" "	..	38
<i>Lepidiota</i> , sp. (No. 683)	..	..	..	" "	..	39
<i>Lepidiota</i> , sp. (No. 215)	..	..	..	" "	..	39
<i>Lepidiota</i> , sp. (No. 666)	..	..	..	" "	..	41
<i>Lepidiota froggatti</i> , Mael.	..	..	..	" "	..	41
<i>Monocrepidius</i> , sp.	..	..	..	" sets	..	17
<i>Pentodon australis</i> , Blackb.	..	..	..	" "	..	16
<i>Rhyparida didyma</i> , Fab.	..	..	..	" foliage	..	28
<i>Rhyparida morosa</i> , Jac.	..	..	..	" "	..	27
<i>Rhyparida</i> (var. <i>hasipennis</i> , Lea ?)	..	..	..	" "	..	28
<i>Rhabdocnemis obscurus</i> , Boisd.	..	..	..	" stalks	..	9
<i>Stenocorynus aridus</i> , Pase.	..	..	..	" foliage	..	28
<i>Xylotrupes australicus</i> , Thomp.	..	..	..	" roots	..	41

Lepidoptera (Butterflies and Moths.)

<i>Chusaris rhodias</i> , Turner	..	..	..	Injuring foliage	..	25
<i>Cirphis unipuncta</i> , Haw.	..	..	..	" "	..	22
<i>Cosmopteryx</i> , sp.	..	..	..	" "	..	15
<i>Diatraea saccharalis</i> , Fabr.	..	..	..	" stalk	..	9
<i>Euproctis holocantha</i> , Turner	..	..	..	" foliage	..	27
<i>Harmoloba miserana</i> , Wlk.	..	..	..	" "	..	26
<i>Loxostoma</i> , sp.	..	..	..	" buds and leaf-sheath	..	15
<i>Opogona glycyphaga</i> , Meyr.	..	..	..	" "	..	11
<i>Padraona marnas</i> , Feld.	..	..	..	" foliage	..	25
<i>Phragmatiphila truncata</i> , Walk.	..	..	..	" stalk	..	7
<i>Polyocha</i> , sp.	..	..	..	" "	..	10
<i>Telicota augias-kreffti</i> , Mael.	..	..	..	" foliage	..	24

Orthoptera. (Grasshoppers, &c.)

<i>Atractomorpha crenaticeps</i> , Blanch.	..	..	..	Injuring foliage	..	21
<i>Cyrtacanthracris guttulosa</i>	..	..	..	" "	..	22
<i>Cyrtacanthracris plagiata</i>	..	..	..	" "	..	22

						PAGE.
<i>Cyrtacanthracris</i> , ? <i>proxima</i> , Walk.	..	..	..	Injuring foliage	..	21
<i>Eutermes fumigatus</i>	..	..	..	„ sets	..	17
<i>Locusta australis</i> , Brunner.	..	..	..	„ foliage	..	18
<i>Locusta danica</i> , Linn	..	..	..	„ „	..	18
<i>Oxya velox</i> , Fab.	..	..	..	„ „	..	21
<i>Termes meridionalis</i>	..	..	..	„ sets	..	17

Heteroptera (Leaf Hoppers, Aphides, etc.)

<i>Aleurodes berghi</i> , Signoret	..	..	..	Injuring foliage	..	31
<i>Aphidid</i>	..	..	..	„ shoots and buds	..	31
<i>Aphis adusta</i>	..	..	..	„ foliage	..	30
<i>Aphis</i> , sp.	..	..	..	„ „	..	30
<i>Aphis</i> , <i>sacchari</i>	..	..	..	„ „	..	29
<i>Perkinsiella saccharicida</i> , Kirk.	..	..	..	„ „	..	29
<i>Pseudococcus</i> (<i>calceolariae</i> , Mask ?)	..	..	..	„ buds and foliage	..	32
<i>Ripersia</i> , sp.	..	..	..	„ “sets”	..	32
<i>Tetigonia parthaon</i> , Kirk.	..	..	..	„ foliage	..	29

(COMMON NAMES.)

INSECTS AFFECTING SUGAR-CANE.

Army Worm	..	..	..	..	Injuring foliage	..	22
Beetle Borer	..	..	..	..	„ stalk	..	9
Black Gauger	..	..	..	..	„ sets	..	16
Brown-tail Moth	..	..	..	..	„ foliage	..	27
Bud aphidid	..	..	..	..	„ shoots and buds	..	31
Bud Moths	..	..	..	..	„ buds and stalk	..	11-15
Chaffer Beetle	..	..	..	..	„ roots	..	41
Christmas Beetle	..	..	..	..	„ „	..	40
Cockchafer Beetles	..	..	..	..	„ „	..	35-39
Dynastid Beetles	..	..	..	..	„ „	..	39-41
Elephant Beetle	..	..	..	..	„ „	..	41
Grass Worm	..	..	..	..	„ foliage	..	25
Large Mottled Locust	..	..	..	..	„ „	..	18
Leaf-eating Weevil	..	..	..	..	„ „	..	28
Leaf Hoppers	..	..	..	..	„ „	..	29
Leaf-rib Borer	..	..	..	..	„ „	..	15
Long-nosed Locust	..	..	..	..	„ „	..	21
Mealy-backed Cockchafer	..	..	..	..	„ roots	..	35
Mealy Bug..	..	..	..	..	„ foliage	..	32
Moth Stalk-Borer	..	..	..	..	„ stalk	..	9
Moth Shoot-Borer	..	..	..	..	„ „	..	10
Noctuid Moth-Borer	..	..	..	..	„ „	..	7
Plant-eating Beetles	..	..	..	..	„ foliage	..	27
Plant Lice	..	..	..	..	„ „	..	29-31
Rutelid Beetle	..	..	..	..	„ roots	..	40
Scale Insect	..	..	..	..	„ „	..	32
“Set” Eater	..	..	..	..	„ “sets”	..	16
Short-horned Locusts	..	..	..	..	„ foliage	..	21
“Skip Jack” Beetle	..	..	..	..	„ sets	..	17
Skipper Butterflies	..	..	..	..	„ foliage	..	22-25
Snow Fly	..	..	..	..	„ „	..	31
Web Worm	..	..	..	..	„ „	..	26
White Ants	..	..	..	..	„ “sets”	..	17
Wireworm	..	..	..	..	„ “sets” and buds	..	17
Yellow-winged Locust	..	..	..	..	„ foliage	..	18

SMITHSONIAN INSTITUTION LIBRARIES



3 9088 01267 6565